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Bosq (J. M.). **Enumeración de predatores observados en la República Argentina (Coleópteros y Hemípteros).** [A List of Predators observed in Argentina (Coleoptera and Hemiptera).]—[*Publ. Inst. Sanid. veg.*] *Minist. Agric. Argent.* (A) **8** no. 54, 29 pp., 13 refs. Buenos Aires, 1952.

Some 70 Coleoptera and 20 Hemiptera are recorded in this list as predacious or probably predacious on phytophagous insects or mites in Argentina. Distribution records are given for the majority, together with notes on the importance of many of them, the prey attacked or the plants on which they were found

Ivy (E. E.). **Chemical Characteristics of Phosphorus Compounds to kill Aphids and Spider Mites by Systemic Action.**—*Agric. Chem.* **8** no. 4 pp. 47–50, 137, 139, 7 refs. Baltimore, Md., 1953.

Insecticidal phosphorus compounds have been shown by Schrader to be characterised by a phosphorus atom linked to two alkyl, alkoxy or alkylamino groups and one acid group by single bonds and to oxygen or sulphur by a double bond. Tests of such compounds at College Station, Texas, since 1949 showed that only a small number of them had a systemic effect against the cotton Aphid [*Aphis gossypii* Glov.] and Tetranychid mites on cotton and that this was associated with certain acid groups (anhydride linkages).

Linkages that conferred systemic activity included those through oxygen to another phosphorus radical of similar form, as in schradan (octamethyl pyrophosphoramide) [*cf. R.A.E.*, A **40** 325] and in diethoxythiophosphoryl tetramethyldiamido phosphate, decamethylpentamido triphosphate and symmetrical and asymmetrical forms of O,O-diethyl bis(dimethylamido) pyrophosphate, which were less effective than schradan. Schrader found that O,O,O-triethyl dimethylamido pyrophosphate and O-ethyl tri(dimethylamido) pyrophosphate acted systemically. Tetra(isopropylamido) pyrophosphate also showed systemic properties, but tetraethyl pyrophosphate and the tetraethyl, tetramethyl and tetra-n-propyl dithiopyrophosphates did not.

In α-diethoxyphosphinodithioacetylurea, linkage to a sulphidoacetylurea group ($-SCH_2CONHCONH_2$) resulted in a compound with six and ten times the systemic action of schradan against *A. gossypii* and the Tetranychids, respectively, on cotton seedlings in nutrient solution.

This compound was much more active than schradan when applied as a spray or seed treatment, but retained its effectiveness for only four weeks after application to the soil. Its dimethyl homologue, α-dimethoxyphosphinodithioacetylurea, had less systemic action, being about equal to schradan in nutrient solution, superior as a seed treatment and effective for a shorter time in the soil. Linkage to a sulphidoacetamide group ($-SCH_2CONH_2$) resulted in less effective systemic action; diethoxyphosphinodithioacetamide had only one-tenth the systemic activity of the corresponding acetylurea compound, its dimethyl homologue less, and the n-propyl derivative and a derivative produced by substituting ethyl groups for hydrogen on the amino nitrogen, N,N-diethyl dipropoxyphosphinodithioacetamide, less still.

Linkage to fluorine resulted in compounds so volatile that they were not effectively translocated when applied to foliage, but had to be applied to the soil or seed; bis(dimethylamido) phosphoryl fluoride, dimethylamido (isopropylamido) phosphoryl fluoride and bis(isopropylamido) phosphoryl fluoride (in order of decreasing toxicity) were more effective than schradan against *A. gossypii* and the Tetranychids, but more phytotoxic. Bis-

(dimethylamido) phosphoryl azide and bis(isopropylamido) phosphoryl azide, in which the phosphorus is linked to a triazo group, were more effective than the corresponding fluorides when tested in nutrient solution against *A. gossypii*, and 2-chlorovinyl diethyl phosphate, 1-carbomethoxy 1-propen-2-yl dimethyl phosphate and the ethyl ester of α-diethoxyphosphinoacetoacetic acid, in which it is linked to an unsaturated aliphatic group, showed systemic properties, the first two being more effective than schradan against *A. gossypii* in nutrient-solution and seed treatments, but more phytotoxic. The best known example of linkage to an alkyl-mercapto-alkoxy group is Systox (O,O-diethyl O-(ethylmercaptoethyl) thiophosphate), which was more effective than schradan against *A. gossypii* and the mites when applied to seed, soil or leaves or in nutrient solution and showed marked contact and vapour toxicity [*cf.* **40** 124]. Changing the length of the carbon chain in the alkyl-mercapto-alkoxy group resulted in O,O-diethyl O-(methylmercaptoethyl) thiophosphate, which seemed to have greater systemic activity than Systox against *A. gossypii* and the mites and is considered a very promising compound; O,O-diethyl O-(butylmercaptoethyl) thiophosphate and O,O-diethyl O-(hexylmercaptoethyl) thiophosphate, which were about as effective as Systox; and O,O-diethyl O-(ethylmercaptopropyl) thiophosphate and O,O-diethyl O-(ethylmercaptobutyl) thiophosphate, which were less active; whereas substitution resulting in O,O-diethyl O-(ethylmercapto-isopropyl) thiophosphate had no effect on systemic activity. O,O-diethyl S-(ethylmercaptoethyl) thiophosphate, an isomer of Systox [*cf.* **40** 327], was three times as effective as Systox itself, but eight times as phytotoxic to cotton plants.

The systemically active compounds referred to above are acid anhydrides of substituted phosphoric acids having potential sites of enzymatic association as a part of the anhydride linkage. It seems probable that compounds containing certain groups may form molecular complexes with plant enzymes or other plant constituents; when an insect ingests plant sap containing the molecular complex, the acid anhydrides convey a substituted phosphoric acid residue to a vital insect enzyme and attach it to a site normally occupied by an unsubstituted phosphate. These compounds are translocated from any part of the plant to the whole of it, and treated plants may remain toxic to insects for several months.

Another type of systemic action, in which translocation is more local and possibly purely mechanical, results from linkage to the p-nitrophenoxy group. The compounds formed are not translocated when applied to foliage, but some were translocated from nutrient solutions. When applied to cotton seeds, they were all ineffective against the mites or *A. gossypii* on the true leaves of the seedlings, though some retained their effectiveness against certain chewing insects to the sixth and eighth true leaf. Paraoxon (diethyl p-nitrophenyl phosphate) was about as effective as Systox in nutrient solution, and more effective in cotyledons after seed treatment, but extremely phytotoxic at insecticidal dosages. Parathion [O,O-diethyl O-p-nitrophenyl thiophosphate], methyl-parathion [O,O-dimethyl O-p-nitrophenyl thiophosphate], O-methyl O-isopropyl O-p-nitrophenyl thiophosphate, O-methyl O-n-propyl O-p-nitrophenyl thiophosphate and O-methyl O-n-butyl O-p-nitrophenyl thiophosphate exhibited limited systemic action; they were less phytotoxic than paraoxon but caused plant injury at insecticidal dosages.

Toxic phosphorus compounds that showed no systemic action included those having as part of the anhydride linkage saturated, unsubstituted aliphatic or aromatic groups or these groups containing chlorine or NH_2, SO_3, COOH, OH, CO or OCH_3 radicals.

Wilbur (D. A.). **Effectiveness of Dusts containing Piperonyl Butoxide and Pyrethrins in protecting Wheat against Insects.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 913–920, 3 refs. Menasha, Wis., 1953.

Following promising results in 1950, dusts of pulverised wheat impregnated with piperonyl butoxide and pyrethrins were tested for the control of insects attacking stored wheat in farm bins in Kansas in 1951, when rain resulted in grain with a high moisture content. The wooden bins were thoroughly cleaned and, in most cases, sprayed with an insecticide before harvest, and the dusts were applied to the surface of the wheat in the trucks and became mixed with it during transference to the bins. A small additional amount was raked into the top layer in each bin, so that the upper 3 ins. received a double dosage. Samples of treated and untreated wheat taken on five dates between 9th August and 9th November were examined immediately, and after storage for 35 days at about 80°F. and 75 per cent. relative humidity. The insects found comprised at least 18 species, of which the cadelle [*Tenebroides mauritanicus* (L.)] was by far the most numerous and species of *Laemophloeus*, including *L. minutus* (Ol.) and *L. ferrugineus* (Steph.), and the saw-toothed grain beetle [*Oryzaephilus surinamensis* (L.)] were also common. The rice weevil [*Calandra oryzae* (L.)] and granary weevil [*C. granaria* (L.)] were not present in significant numbers.

The most effective of the dusts tested was one that contained 1·1 per cent. piperonyl butoxide and 0·08 per cent. pyrethrins, which was applied at 75 lb. per 1,000 bushels grain. The numbers of *Tenebroides*, *Laemophloeus* and *Oryzaephilus* found in samples of untreated wheat and wheat treated with it on ten farms are shown in a table. The totals were 880, 641 and 128 for probe samples and 2,916, 1,940 and 242 for samples of 1 U.S. gal. taken from the upper 12 ins. in untreated grain, and 41, 122 and 16 for probe samples and 39, 78 and 0 for the others in treated grain. The percentages of samples that would have been officially graded as infested were 61·6 for the untreated and 14·8 for the treated grain and microscopic examination showed appreciably higher kernel damage in the former.

Roan (C. C.). **Reactions of Oriental Fruit Fly to high Temperatures and various relative Humidities.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 920–925, 8 figs., 4 refs. Menasha, Wis., 1953.

Temperature-gradient experiments showed that adults of *Dacus ferrugineus dorsalis* Hendel tended to avoid temperatures above 35°C. [95°F.]. They were very active at the hot end, with considerable movement in and out of the warmer region, but did not attempt to move at temperatures of the order of 20°C. [68°F.]. At temperatures above 41°C. [105·8°F.] they very soon became prostrate, and in tests in which they were introduced into heated flasks, the time taken for complete knockdown from heat rigour ranged from 20 seconds at 50°C. [122°F.] to 15 minutes at 43°C. [109·4°F.]. At temperatures below 43°C., the flies died more rapidly at low than at high humidities, but above 43°C., the reverse was the case, suggesting that the body temperature can be lowered for a short time by evaporation. This was confirmed by thermocouple measurements of actual body temperature, this rising more rapidly in flies introduced into hot flasks at 100 per cent. than at 0 per cent. relative humidity. That this was not due to the latent heat of moisture condensing on flies introduced into flasks containing saturated air was shown by gradually warming flasks containing flies, when a lag in the rise of body temperature of flies in dry air was still observed.

WENE (G. P.), BLANCHARD (R. A.) & WALTER (E. V.). **Relation of Corn Earworm Resistance in Sweet Corn to Efficiency of Insecticide Sprays.** —*J. econ. Ent.* **45** (1952) no. 6 pp. 931–933. Menasha, Wis., 1953.

An account is given of experiments in 1949–50 to ascertain whether the use of resistant hybrids would assist in the control of *Heliothis armigera* (Hb.) on sweet maize in the Lower Rio Grande Valley of Texas, where damage is usually severe. Five hybrids, notably Calumet, proved superior to Ioana, the susceptible strain normally grown, when infestation was heavy, and seven, including Calumet and Flagship, when it was moderate. When sprays were applied to the silks of individual ears, a single application of 1 per cent. DDT in oil resulted in nearly 70 per cent. uninfested ears (commercial control) on Calumet and only 33 per cent. on Ioana, as compared with 0 for untreated plants of either hybrid, but damaged about 30 per cent. of the ear tips. Three applications of 1 per cent. DDT with 10 per cent. oil in an emulsion spray at intervals of two days gave better control on the more resistant hybrids, including Calumet, than on Ioana when infestation was severe but not when it was moderate, and two applications at an interval of three days proved as effective as three on two of the hybrids, including Flagship, when infestation was moderate.

It was observed that in untreated commercial fields subject to severe infestation, the percentage of cull ears harvested was usually less on resistant hybrids, such as Calumet or Flagship, than on others.

MUNDINGER (F. G.). **Control of Pear Psylla.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 934–939. Menasha, Wis., 1953.

Populations of overwintering adults of *Psylla pyricola* Först. on pear have been moderate in western New York in recent years, but have commonly given rise to injurious numbers during the summer, and attempts were made in 1948–51 to find a dormant spray treatment that would control the first generation sufficiently to prevent the later increase. A superior dormant oil [*cf. R.A.E.*, A **38** 109], DNC, the sodium salt of DNC, the triethanolamine salt of dinitro-o-sec.-butylphenol, parathion, BHC, malathon, DDT and EPN [O-ethyl-O-p-nitrophenyl benzenethiophosphonate] were applied at various concentrations during the late dormant stage (from the time when the fruit buds are swelling appreciably until the terminal bud scales have separated), and all but BHC proved very effective. The sodium salt of DNC, applied during the early dormant stage (before the buds begin to swell appreciably), gave good immediate but poor residual control, and this was improved by the application of an oil spray at the late dormant stage. Most of the effective materials acted by killing the eggs, but the main effect of the oil was to kill the newly hatched nymphs. Malathon either severely weakened the developing embryos or left residues extremely toxic to the nymphs.

The late dormant period appeared to be optimum for treatment, but in further tests, parathion, other phosphorus compounds and ground derris root with oil were also very effective when applied in July. In view of the rapid rate of increase of the Psyllid, concentrations of 3 U.S. quarts 22 per cent. sodium salt of DNC, 2 U.S. quarts 36 per cent. triethanolamine salt of dinitro-o-sec.-butylphenol, 2 U.S. gals. superior dormant oil, 1·25 lb. 15 per cent. parathion wettable powder or 1·25 U.S. pints 50 per cent. malathon emulsion concentrate per 100 U.S. gals., which are greater than the minimum concentrations found effective in these tests, are recommended for application against the first generation.

MIDDLEKAUFF (W. W.) & STEVENSON (E. E.). **Insect Injury to Blackeye Bean Seeds in central California.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 940–946, 3 figs., 9 refs. Menasha, Wis., 1953.

The following is based on the authors' summary. During 1951, fields of cowpeas in Stanislaus County, California, were dusted with 5 per cent. DDT or 10 per cent. toxaphene by aeroplane or left untreated, small plots of about an acre in undusted fields were treated by hand with a dust containing 5 per cent. DDT and 50 per cent. sulphur, and all were surveyed at harvest for insect damage. *Lygus hesperus* Knight and *L. elisus* Van D., of which the former was the more numerous, caused most of the insect damage found, and every sample from undusted fields showed typical necrotic lesions caused by their feeding, the percentages of seeds affected varying from 4·8 to 30·6 and averaging 14·1. The *Lygus* bugs are commonest on lucerne, but appreciable numbers complete their life-cycle on cowpeas, and the numbers are augmented by adults migrating when neighbouring lucerne fields are cut. Samples of cowpeas taken at varying distances from infested lucerne showed a direct correlation between amount of seed injury and proximity to the lucerne. *Lygus* damage was considerably reduced in many of the fields treated with DDT or toxaphene, the percentages of seeds injured varying from 0·4 to 15 and averaging 4·4. Samples of untreated cowpeas taken near the small treated plots showed 9·6–28·3 per cent. *Lygus* injury, as compared with 0·7–5·4 per cent. from the treated plots.

Some damage was caused to the developing seeds by Lepidopterous larvae, of which *Heliothis armigera* (Hb.), *Etiella zinckenella* (Treitschke) and *Prodenia praefica* Grote were the most important. Examination of seed samples showed that *E. zinckenella* was responsible for most of the damage in the large fields. This species is not controlled by either DDT or toxaphene, and causes serious injury, cowpea being a favoured food-plant. Treated and untreated fields showed averages of 1·8 and 2·5 per cent. injury due to Lepidoptera, but treatment was more effective in the small plots, where *H. armigera* was commoner than *E. zinckenella* and was controlled by DDT. Treatment with DDT or toxaphene also gave some control of *Bruchus* (*Callosobruchus*) *maculatus* F., which was not common.

BRUNSON (M. H.) & KOBLITSKY (L.). **Parathion, DDT and EPN Deposits on Peach Foliage and Fruit.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 953–957, 5 refs. Menasha, Wis., 1953.

The following is based largely on the authors' summary. Investigations were carried out near Moorestown, New Jersey, in 1950 and 1951 to determine the loss of residues of parathion, DDT and EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] from the sprayed leaves and immature fruits of peach, the residues left on the fruits at harvest and the effectiveness of these insecticides in protecting the ripe fruits against *Cydia* (*Grapholitha*) *molesta* (Busck). Parathion was used at 2 lb. 15 per cent. wettable powder per 100 U.S. gals., EPN at 1·5 lb. 25 per cent. wettable powder and DDT at 2 lb. 50 per cent. wettable powder in 1950 and 1·5 lb. 75 per cent. wettable powder in 1951. Parathion was applied three times at intervals of two weeks, with the last application two weeks before harvest, or twice at an interval of three weeks, with the last spray three weeks before harvest, and EPN according to the second of these schedules; DDT was used before or after parathion, the two sprays being applied six and three weeks before harvest, respectively. The percentage losses of residue from leaves one, two and three weeks after application averaged about 94, 99 and 100 for parathion, 70, 76 and 85 in 1950 and 33, 46 and 53 in 1951 for DDT, and 83, 92 and 97 for EPN. Parathion and EPN residues were lost at a considerably lower rate from fruits than from leaves, and DDT at about the same rate from both. The residues on ripe fruits two and three weeks after application averaged 0·24 and 0·1 part per million for parathion, 6·4 and 5·9 p.p.m. for DDT and 0·52 and 0·36 p.p.m. for EPN. There were no significant differences between schedules in the reduction of injury by *C. molesta* to the ripe fruits; the average reduction was 84·1 per cent., as compared with no treatment.

Kriner (E. R.), Dewey (J. E.) & Norton (L. B.). **Orchard Evaluation of DDT Formulations and DDT-Acaricide Combinations.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 957–965, 10 refs. Menasha, Wis., 1953.

The following is based largely on the authors' summary. During 1950 and 1951, six field experiments were carried out on apple in New York in an attempt to obtain effective control of insects and mites with lower concentrations of DDT than those normally used and thus reduce the residues on the fruits at harvest. DDT fused on Barden Clay or extracted tobacco stems, mechanically mixed DDT, these preparations mixed with parathion, EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] or DMC [1,1-bis(p-chlorophenyl)ethanol] (as acaricides) in the tank just before spraying, and combinations of DDT fused on tobacco stems with parathion, EPN or DMC were applied in 4–6 cover sprays, and their insecticidal and acaricidal effectiveness, deposition, rate of weathering and residues at harvest compared.

The fused and mechanical preparations of DDT showed no significant differences in the control of codling moth [*Cydia pomonella* (L.)], the red-banded leaf roller [*Eulia velutinana* (Wlk.)], the European red mite [*Paratetranychus pilosus* (C. & F.)] or the two-spotted mite [*Tetranychus bimaculatus* Harvey], and lowering the concentration of actual DDT from 1 lb. to 0·75 lb. per 100 U.S. gals. reduced the residue at harvest by about a third with no significant increase in insect injury. DDT fused on Barden Clay gave the highest deposits and residues on the fruits, and the mechanical mixture and DDT fused on tobacco the highest deposits and residues, respectively, on the foliage. DDT fused on tobacco left DDT residues 10 per cent. or more below those from the mechanical mixture on the fruits at harvest. No significant differences in control resulted from differences in deposits, weathering or residues.

In the acaricidal mixtures, DDT was used at 0·75 and the acaricide at 0·09 lb. per 100 U.S. gals. DDT with parathion gave excellent control of the insects and mites, and was significantly superior to DDT alone against each of them. A spray interval of 14 days or less was necessary for good control of *E. velutinana*. Parathion combined with DDT on tobacco was more effective against the mites than parathion tank-mixed with any DDT formulation, possibly because it gave a higher parathion deposit. Although the former weathered more rapidly, DDT residues were about equal, and there was no difference between the two methods of preparation in the control of the insects.

Tank-mixed sprays of DDT with parathion, EPN and DMC did not differ greatly in effectiveness against *C. pomonella* or the mites, but the first was significantly better than the others against *E. velutinana*; the differences in deposits and residues were not sufficient to account for the difference in control. The tank-mixed spray of DDT and EPN gave better control of both insects and both mites than EPN combined with DDT fused on tobacco, although the deposits and residues of DDT and EPN did not differ appreciably. Control of *E. velutinana* when the interval between sprays was 10 days was better than when it was 14 days and significantly better than when it was 18 days. Tank-mixed DDT and DMC gave significantly better control of *E. velutinana* and better control of *C. pomonella* and the mites than DMC with DDT fused on tobacco.

EPN residues were about equal to those of parathion on the fruits and about three times as high on the foliage. Treatment with EPN caused no visible injury on the fruits or foliage of the McIntosh variety. In both seasons, a few sprays were applied with a mist sprayer, at about eight times the normal concentrations, and no parathion injury to fruit or foliage of the McIntosh, Cortland or R. I. Greening varieties was observed from either dilute or concentrated sprays in which parathion was applied with DDT.

Ritcher (P. O.), Kulash (W. M.), York jr. (E. T.) & Cooper (W. E.). **Control of Rootworms affecting Peanuts.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 965–969, 2 graphs, 8 refs. Menasha, Wis., 1953.

Diabrotica undecimpunctata howardi Barber has been a serious pest of groundnuts in North Carolina for many years. The larvae gnaw the surface of the underground stems and tunnel through the cotyledons when the young plants are emerging, destroy the tips of the pegs that would normally form pods, and later tunnel through the immature and mature pods. Soil insecticides, applied with fertiliser, and insecticidal dusts and sprays, applied to the foliage and adjacent soil, were tested for their control in 1949–51. BHC powder (6 per cent. γ isomer), applied in a spray when the plants first showed, and γ BHC as lindane, applied with fertiliser or as an early bloom spray, at 1 lb. toxicant per acre, and dieldrin at 1 lb., aldrin at 2 lb. and heptachlor at 1–2 lb., applied with fertiliser or as sprays or dusts during the early pegging period, all gave good or excellent control, the method of application making little difference to the results. Yields were increased by 600–800 lb. per acre in some tests. Chlordane at 2–4 lb. per acre was fairly effective as a spray or dust and less so when applied with fertiliser, but chlordane at 4 lb. and heptachlor at 2 lb. in sprays caused severe temporary injury to the foliage, which did not, however, affect the yield. DDT controlled a light infestation when applied at 3–6 lb. per acre in a dust after plant emergence or in the early pegging stage, but gave poor control of a heavy infestation when applied with fertiliser or in an early-bloom spray at 1–4 lb. per acre. Toxaphene was ineffective at 4 lb. per acre in a spray or dust or applied with fertiliser. Injury due to larvae of *Systena elongata* (F.) and wireworms of the genus *Melanotus* was observed on plots dusted with heptachlor.

Treatment with BHC affected the flavour of oil-cooked or roasted groundnuts and groundnut butter, and treatment with lindane that of the butter. There was some evidence that chlordane applied as a spray at 2–4 lb. per acre affected the flavour of the cooked nuts, and, in one test only, that 2 lb. heptachlor in fertiliser also affected it. No other treatment caused a change of flavour.

Summers (F. M.). **New Materials in early Sprays for Control of Brown Almond Mites.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 974–981, 3 refs. Menasha, Wis., 1953.

On almond and peach in California, fungi of the genera *Sclerotinia* and *Coryneum*, the twig borer, *Anarsia lineatella* Zell., and the mite, *Bryobia praetiosa* Koch, often all need controlling early in the season, and as a combined pre-bloom treatment would be convenient, attempts were made to find an acaricide that would be compatible with basic lead arsenate or DDT and with bordeaux mixture or other copper fungicides. In preliminary tests, Ovotran (50 per cent. p-chlorophenyl p-chlorobenzenesulphonate in a wettable powder) was particularly promising, and field tests were carried out with this and other materials in 1950–52.

A single pink-bud spray of 1·5–2 lb. Ovotran per 100 U.S. gals. gave good control of the mite on almond, keeping leaf infestation very low throughout the period of attack, and fair control on peach. Pink-bud applications of 1·5–2 pints Genite EM-923 [50 per cent. 2,4-dichlorophenyl benzenesulphonate in an emulsion concentrate] per 100 gals. gave excellent control on both almond and peach. Petal-fall applications of these two acaricides were as effective as pre-bloom sprays, but the foliage injury caused by immature mites that hatched during the period of bloom persisted. Sprays applied later than petal-fall were slow in action, but gave good ultimate control. Neither material was affected by the addition to the sprays of basic lead arsenate, DDT, bordeaux mixture or other copper fungicides, oil emulsion, wetting agents or deposit builders, and neither of them injured the trees or affected the flavour of almonds. Both showed ovicidal action.

In tests of further acaricides, mostly tried alone, a single application of dinoseb (triethanolamine) in the form of 2 U.S. quarts DN-289 (1 lb. active ingredient) per 100 U.S. gals. to almond two weeks before the pink-bud stage gave excellent mite control for at least three months; it was not determined whether such an application would make additional fungicidal sprays unnecessary. Applications of 10 U.S. gals. lime-sulphur in a semi-dormant spray, 3 U.S. gals. lime-sulphur with 5 lb. wettable sulphur in the pink-bud spray or 1 U.S. gal. lime-sulphur with 5 lb. wettable sulphur in the early petal-fall period, all per 100 U.S. gals., gave good control on almond in some localities, though the last caused slight scorching on tender shoots. In the post-bloom period, sprays containing colloidal sulphur paste or colloidal bentonite-sulphur were significantly better than sprays containing a higher percentage of ordinary wettable sulphur. In other districts, sprays containing various amounts of lime-sulphur, sulphur or mixtures of the two did not give adequate control on peach or almond. Karathane [wettable dinitrocaprylphenylcrotonate] and Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] gave outstanding and moderate control, respectively, on almond, but combinations of Aramite and oil caused slight plant damage. Sulphenone [p-chlorophenyl phenyl sulphone] and malathon gave poor results in preliminary tests.

It is concluded that the acaricides that are most effective in the near-bloom periods act chiefly by killing the eggs or young mites and are slow in action against the adults; they give the best results when the wood is thoroughly soaked with the spray.

Carter (Walter). **Organic Phosphates as systemic Insecticides on Pineapple Plants.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 981–984. Menasha, Wis., 1953.

An account is given of preliminary experiments in Hawaii in which parathion, Systox [O-(2-(ethylmercapto)ethyl) O,O-diethyl thiophosphate] and malathon were tested as contact and systemic insecticides for the control of *Dysmicoccus* (*Pseudococcus*) *brevipes* (Ckll.) on pineapple. When infested fruits were dipped in the test fluids in the laboratory, 25 per cent. parathion wettable powder and 50 per cent. Systox emulsion concentrate gave complete kills at dilutions of 1:800 and 1:2,000, respectively, and 25 per cent. malathon wettable powder and 50 per cent. malathon emulsion concentrate almost complete kills at 1:500. Parathion applied to the soil surface at 2·5–10 lb. per acre and hoed in on 28th October, 12 days before planting, gave no control of mealybugs on the plants during the following summer. The Systox concentrate at 1:500, painted on one surface of the lower third of detached pineapple leaves, showed a short residual effect against mealybugs caged on the lower surface when applied to the lower surface, but no movement upwards, and slight movement upwards but no effect on the lower surface, when applied to the upper surface. Toxicity was negligible on leaves exposed to outside light for 24 hours before being infested. Sprays of 1–4 U.S. quarts Systox concentrate in 400 U.S. gals. water per acre caused no mortality of mealybugs caged on rapidly growing leaves 1–4 weeks after treatment, and the application of 9·92 lb. actual Systox per acre to the soil in solution or with a fumigant before pineapple slips were planted was also ineffective. In field tests in which 1–4 U.S. pints Systox concentrate, 8 lbs. 25 per cent. malathon wettable powder and 2 U.S. quarts 50 per cent. malathon concentrate in approximately 500 U.S. gals. water per acre were applied to pineapple plants three times at monthly intervals, the three materials gave satisfactory control by contact but had little or no effect on mite colonies below the soil surface. No external or internal malathon residues were detected in leaf samples 22 days after the second application or 17 days after the third; Systox residues were 0–0·5 part per million in old leaves and 0–0·1 p.p.m. in the youngest ones.

Yust (H. R.). **Visible Reactions of California Red Scale in Relation to Resistance to Fumigation with HCN.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 985–987, 9 refs. Menasha, Wis., 1953.

The following is almost entirely the author's summary. Observations were made in 1949 and 1950 on adults of *Aonidiella aurantii* (Mask.) of strains that were non-resistant, resistant and super-resistant to hydrocyanic acid gas to determine whether tracheal closure or other visible reactions to fumigation were the cause of resistance [*cf. R.A.E.*, A **31** 329, etc.]. Individual scales were studied both during and after fumigation. The tracheae of the three stocks reacted differently to the fumigant. Shortly after exposure began, most of the tracheae of the non-resistant scales were open and most of those of the resistant and super-resistant scales closed. As the exposure period increased, the tracheae of the non-resistant scales tended to close and those of the super-resistant scales to open. The results did not indicate that tracheal closure caused resistance, nor was any other reaction observed that could account for it.

Metcalf (R. L.) & March (R. B.). **Behavior of Octamethyl Pyrophosphoramide in *Citrus* Plants.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 988–997, 1 fig., 10 refs. Menasha, Wis., 1953.

The following is substantially the authors' summary. Schradan prepared from radioactive phosphorus (P^{32}) was used to study the behaviour of this systemic insecticide in lemon and orange plants, and its toxicity to *Paratetranychus citri* (McG.) and *Heliothrips haemorrhoidalis* (Bch.). When applied in water culture to the roots of lemon seedlings, schradan was readily absorbed and transported to the leaves in rapidly increasing amounts over a 46-day period. Only a small fraction was metabolised in the plant to alkali-soluble, chloroform-insoluble products, although the leaf sap became appreciably toxic to *P. citri* within 12–24 hours. The intake of schradan was not greatly different from that of radioactive orthophosphoric acid similarly applied.

Leaf sap from plants containing relatively large amounts of schradan only slightly inhibited fly-brain cholinesterase, and the activity seemed largely independent of the total schradan concentration. This indicates that any toxic metabolite formed is rapidly decomposed and does not accumulate, as do schradan or other metabolites. The distribution of schradan was surprisingly uniform in leaves on various parts of the plant, and leaves accumulated a greater weight of schradan than roots or stems. Translocation was appreciable in all directions from the source of application, but appeared to be greatest in the direction of the most rapidly growing leaves.

Schradan applied to the bark at the base of orange seedlings was rapidly absorbed and translocated to the leaves in amounts highly toxic to *P. citri*, and a pronounced concentration appeared in the terminal leaves. The efficiency of absorption was somewhat greater from this type of application than from applications in water culture. Schradan applied to lemon leaves was rapidly absorbed, and about 50 per cent. of it penetrated into them within 48 hours. When a single leaf was treated, 0·1–1 per cent. of the total dosage passed to other leaves of the plant within 17 days. Schradan applied to lemon and orange fruits was absorbed more quickly into the peel than similar applications into leaves, but penetration into the pulp was not great. The maximum concentrations of schradan and phosphorus-containing metabolites found in the juice were 0·03 part per million 18 days after the fruits were dipped in 0·036 per cent. aqueous solution, and 0·42 p.p.m. 42 days after dipping in 0·1 per cent. solution.

Concentrations of 20–50 mmg. schradan per gm. leaf tissue caused 50 per cent. mortality of adult females of *P. citri* in 48 hours [*cf. R.A.E.*, A **39** 428] whereas a concentration of about 4,000 mmg. per gm. leaf was required to kill adult females of *Heliothrips*.

Morrison (H. E.) & Crowell (H. H.). **Soil Insecticide Studies in Oregon.** —*J. econ. Ent.* **45** (1952) no. 6 pp. 1002–1010, 2 figs., 9 refs. Menasha, Wis., 1953.

Experiments carried out in Oregon in 1948–49, in which fine sandy loam, loam or clay soils were sprinkled with iron filings and subjected to various combinations of ploughing, rotary tilling and double-disking, showed that soil type and methods of seed-bed preparation and tilling all affected the thoroughness of mixing. A substantial quantity of iron particles was dragged several feet beyond the plot boundaries, and biological observations indicated that similar dragging of insecticides also takes place. Long narrow plots parallel with the direction of tillage and cultivation are therefore considered more desirable than small randomised ones.

In 1948, 18 lb. γ BHC per acre raked into the top 2 ins. of soil gave less control of larvae of *Hylemyia brassicae* (Bch.) and *H. fugax* (Mg.) on turnip than 10 lb. per acre tilled in to a depth of 6 ins., and tests with treated soil layers in 1949 and 1950 showed that insecticide placement was important in determining the degree of mortality; when the BHC was mixed to depths of less than 6 ins., even three times the minimum effective dosage did not result in complete control. Methoxy-DDT (methoxychlor), DDD (TDE), CS–708 [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] and combinations of piperonyl butoxide and pyrethrum proved ineffective against *Hylemyia* and also against *Epitrix tuberis* Gentner.

To test the persistence of soil insecticides, DDT, toxaphene, chlordane, γ BHC, aldrin, dieldrin, parathion and EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] in wettable powders mixed with sand were applied in the spring of 1949 to a depth of 6 ins. at 10 lb. active ingredient per acre, and potatoes, maize, beans, carrots and either turnips or radishes were planted in the plots in 1949, 1950 and 1951. In all three years, toxaphene, chlordane, aldrin, dieldrin and γ BHC gave almost complete control of *E. tuberis* and these materials and DDT of *Limonius canus* Lec. and *L. californicus* (Mannh.), while dieldrin, aldrin and γ BHC were moderately effective against *Hylemyia*. Observations were made in 1950 on adult emergence from treated ground on which turnips had been planted in 1949. Chlordane allowed the larvae to enter turnips to the extent of making 77 per cent. of them unmarketable but almost completely prevented adult emergence; aldrin, dieldrin and BHC prevented both larval attack and adult emergence, and toxaphene gave no control of larvae and resulted in so much adult emergence as to suggest some action on parasites and predators. Good control for one year was obtained with EPN and parathion against *E. tuberis* and the wireworms, and with heptachlor, which was applied only in 1951, against all the insects. In a similar test on peat soil, chlordane at 4–6 lb. and toxaphene at 10–20 lb. per acre, applied dry or in sprays in 1949 and tilled in to a depth of 6 ins., gave highly significant control of *Psila rosae* (F.) on carrot in 1949 and 1950 with no significant differences between treatments. In large-scale field tests, begun in 1951, with aldrin and dieldrin applied in sprays or with fertiliser at different rates and worked into the top 6 ins., *Scutigerella immaculata* (Newp.) was slowly but effectively controlled by 10 lb. per acre of either material thoroughly mixed into the soil, and aldrin controlled unidentified dry-land wireworms at 2 lb. per acre, *L. canus* and *L. californicus* at 5 lb. and *E. tuberis* at 1·5–2 lb., all in potato fields, *P. rosae* at 1 lb. and *H. cilicrura* (Rond.) on lima beans for two years at 5 lb. Deep ploughing of treated plots apparently buried the insecticide too far for the control of *H. brassicae* and *H. fugax*.

DAVIS (D. W.). **Some Effects of DDT on Spider Mites.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1011–1019, 4 graphs, 6 refs. Menasha, Wis., 1953.

The following is based mainly on the author's summary. Experiments in which *Tetranychus multisetis* McG. was reared on ripe banana squash and exposed to deposits of DDT from acetone solution showed that contact with them had several distinct effects both on individuals and on the colonies as a whole. Shortly after initial contact with DDT, the mites became highly active and moved more rapidly and for greater distances than others not so exposed. During this period of increased activity, very few eggs were laid and the mites became widely scattered over the food-plant. This dispersion resulted in a higher reproductive potential and hence in an earlier attainment of maximum population. If the dosages were high enough, there was actual mortality of some mites and increased length of life-cycle. In one of a series of tests with very low dosages of DDT, there was an indication of shortening of the life-cycle. The predators, *Stethorus picipes* Csy. and *Orius tristicolor* (White), both of which were observed to control mite infestations, were shown to be readily killed by DDT. Observation of population trends on treated and untreated squash in the absence of predators confirmed the evidence obtained from studies of individual mites, in that the peak populations were reached earlier on lightly treated surfaces than on either untreated or heavily treated surfaces. Comparison of the habits of *T. multisetis* with those of *T. bimaculatus* Harvey indicated that most of the results would apply also to the latter.

Michelbacher (A. E.) & Bacon (O. G.). **Walnut Insect and Spider-Mite Control in northern California.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1020–1027, 1 fig., 5 refs. Menasha, Wis., 1953.

The following is based on the authors' summary. Investigations in northern California have shown that *Cydia* (*Carpocapsa*) *pomonella* (L.) can be controlled on walnut by a single spray applied just before the first-generation larvae enter the nuts. The development of the trees and the seasonal activity of the moth are related, and as the larvae do not enter the nuts of the Payne variety until these have an average cross-sectional diameter of 0·5 in., spraying can be delayed until the nuts have reached this size. DDT was found to be much more effective than standard lead arsenate, but it should be combined with an effective aphicide in order to avoid a serious increase in population of *Chromaphis juglandicola* (Kalt.) [*cf. R.A.E.*, A **38** 320; **39** 110]. Unless used at low dosages, it is also likely to favour increases of mites, principally *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.) and *Tetranychus pacificus* McG., and of *Eulecanium* (*Lecanium*) *pruinosum* (Coq.).

When sprays were applied with ordinary sprayers equipped with towers, mixtures of 2 lb. standard lead arsenate, 8 oz. 50 per cent. DDT wettable powder, 8 oz. of a safener containing basic zinc sulphate, either 2·67 oz. 25 per cent. wettable parathion or 1 lb. BHC (6 per cent. γ isomer), and 0·33 U.S. gal. light summer oil emulsion (80 per cent. oil) per 100 U.S. gals. were probably the most effective. When air-carrier sprayers were used, the best control of *C. pomonella* was obtained with about 8 lb. 50 per cent. wettable DDT in 200 or 400 U.S. gals. water per acre, and this did not cause increases of mites or *E. pruinosum*. This spray should contain 10 lb. 50 per cent. wettable DDT, 3 lb. DDT depositor and 3 U.S. gals. light-medium summer oil emulsion, with 1·25 lb. 25 per cent. wettable parathion, 9 lb. BHC (6 per cent. γ isomer) or 9 lb. 14 per cent. nicotine dry concentrate per 500 U.S. gals. when used at 400 U.S. gals. per acre, and twice these amounts of DDT, parathion, BHC or nicotine with the same quantities of depositor and oil emulsion per 500 U.S. gals. when used at 200 U.S. gals. per acre. Spraying should be thorough.

A single application of BHC under relatively stable weather conditions early in the season controls *Chromaphis* without affecting the flavour of the nuts, but control with TEPP (tetraethyl pyrophosphate), BHC or parathion is not satisfactory unless the population is practically eliminated from the orchard [*cf.* **39** 110]. Highly satisfactory Aphid control late in the season was given by 1 lb. 25 per cent. wettable parathion, 0·75–1 U.S. pint 40 per cent. TEPP or 7–9 lb. 14 per cent. nicotine dry concentrate in 50 U.S. gals. water per acre applied with air-carrier sprayers of sufficient air capacity. The amount of water per acre should be 100 U.S. gals. if air-carrier sprayers of low capacity are used.

Mites that had increased to a destructive level were controlled by a thorough application of 1–2 lb. 15 per cent. wettable Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] per 100 U.S. gals.

Burkhardt (C. C.). **Feeding and Pupating Habits of the Fall Armyworm in Corn.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1035–1037, 6 figs., 9 refs. Menasha, Wis., 1953.

When *Laphygma frugiperda* (S. & A.) attacks maize, the larvae usually feed on the leaves and in the ears, and pupation normally occurs in the soil. In the autumn of 1951, however, larvae were observed in considerable numbers in Kansas burrowing in the stalks and sometimes causing them to break. On 3rd October, when about 50 per cent. of the maize had tasselled, some 3 per cent. of the stalks in a field in which 70–75 per cent. of the plants were injured showed burrowing by *L. frugiperda*. Many of the larvae pupated in the ears, tassels and whorls of the plants, the proportion doing so amounting to about a quarter in two fields examined, in which the soil was not particularly hard or dry.

DEAN (F. P.) & NEWCOMER (E. J.). **Further Studies of Orchard Acaricides.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1038–1042, 5 refs. Menasha, Wis., 1953.

Tests of sprays for the control of orchard mites on apple were continued at Yakima, Washington, in 1949–51 [*cf. R.A.E.*, A **38** 341]. DDT or methoxy-DDT (methoxychlor) was used to control the codling moth [*Cydia pomonella* (L.)], and the acaricides were added in 1–3 applications in June–July. All spray quantities are given per 100 U.S. gals., and the following is substantially the authors' summary of the results. At least 0·75 lb. 15 per cent. parathion was required for control of *Tetranychus bimaculatus* Harvey, *Bryobia praetiosa* Koch, and *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.), but this amount hardly sufficed to control *T. pacificus* McG., and even 2 lb. was insufficient for effective control of *T.* (*Eotetranychus*) *carpini borealis* Ewing. Malathon at 0·5 U.S. pint 50 per cent. emulsifiable concentrate or 1 lb. 25 per cent. wettable powder controlled all but *T. c. borealis*, and EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] at 0·5 lb. 27 per cent. wettable powder gave excellent control of all but this mite. Metacide [an emulsion concentrate containing 6·2 per cent. parathion, 24·5 per cent. methyl-parathion and 2·7 per cent. related organic phosphates] at 1 U.S. pint controlled *T. bimaculatus*, *B. praetiosa* and *P. pilosus* effectively, but gave poor results against *T. pacificus* and *T. c. borealis*.

Toxaphene had some value, particularly against *B. praetiosa*, but was much less effective than the other materials tested, and DMC [1,1-bis(p-chlorophenyl)ethanol] in a 25 per cent. emulsifiable concentrate had a longer residual effect than any other non-systemic acaricide tested and controlled all species for the season when applied once at 1·5 U.S. pints concentrate in June. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] controlled *T. pacificus* at 1 lb. 15 per cent. wettable powder and *B. praetiosa* and *P. pilosus* at 2 lb., and 0·5 U.S. pint 15 per cent. emulsifiable concentrate gave excellent results against *T. bimaculatus* and *P. pilosus* but only fair control of the other three mites. Ovotran (p-chlorophenyl p-chlorobenzenesulphonate) gave poor control of *T. pacificus* at 1·5 lb. 50 per cent. wettable powder but very good control of the other mites at 1 lb., and 40–50 per cent. R-242 (p-chlorophenyl phenyl sulphone] at 2–3 lb. gave similar results, except that it was less effective against *T. c. borealis*. CS-708 [a 1 :2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] at 2 U.S. pints 25 per cent. emulsifiable concentrate was ineffective against *T. pacificus* and *T. c. borealis*, but quite effective against the other mites.

Of two systemic acaricides applied once to the foliage as sprays, Systox [O-(2-(ethylmercapto)ethyl) O,O-diethyl thiophosphate] had a longer residual effect than schradan, although both were very effective against *I. bimaculatus*, *B. praetiosa* and *P. pilosus*.

Dean (H. A.). **Spider Mites of *Citrus* and Texas Citrus Mite Control in the Lower Rio Grande Valley of Texas.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1051–1056, 5 refs. Menasha, Wis., 1953.

Phyllocoptruta oleivorus (Ashm.) is the most important of the mites that attack *Citrus* in the Lower Rio Grande Valley of Texas. *Eutetranychus* (*Anychus*) *clarki* (McG.) sometimes becomes numerous during late summer and early autumn and other species occasionally occur, though *Paratetranychus citri* (McG.) has apparently not been recorded from the State [*cf. R.A.E.*, A **24** 298–299].

Observations in 1950–52 showed that *E. clarki* feeds on the upper leaf surface and forms no webbing. It prefers *Citrus* but migrates to other plants when populations become excessive. Numbers were relatively low in October 1950, probably owing to heavy rain in September, but had increased by December. Temperatures below 32°F. for 14 hours (minimum 24°F.) on 7th December did not reduce the numbers, but no active mites or eggs could be found in February following temperatures below 25°F. for 20 hours and below 32°F. for 75 hours (minimum 18°F.). The mites reappeared in a few groves by May 1951 and were numerous in late June and early July. Infestation occurred in some areas but not in others in December 1951, and small numbers were present in July 1952, together with the predacious mite, *Typhlodromus* (*Iphidulus*) *finlandicus* (Oudm.). The other phytophagous mites found included *Brevipalpus australis* (Tucker), which was taken on grapefruit leaves in the San Juan area in January 1952. It was widely distributed though nowhere numerous, and preferred the undersides of the leaves; it also attacked the fruits. *Septanychus mexicanus* McG. was found on lemon leaves at Monte Alto, Texas, in January 1951, but was scarce and was not seen after the cold weather at the end of January. *Thyreophagus entomophagus* (Lab.) was found on fruits one inch or more in diameter in several places, but was numerous only on old fruits left on the trees.

T. finlandicus was the most numerous and widely distributed of the predacious mites that attack *E. clarki*. It occurred on *Citrus* in large numbers where populations of *P. oleivorus* and *E. clarki* were heavy and in the absence of the mites where *Parlatoria pergandii* Comst., *Lepidosaphes gloveri* (Pack.) and *Aonidiella aurantii* (Mask.) were common. *Allothrombium* (*Allotrombidium*) sp. was observed feeding on eggs, nymphs and adults of *E. clarki* and also on *P. pergandii* and *L. gloveri*. Unidentified predacious mites of five other genera were also recorded, but their importance in reducing phytophagous mites is not known.

Several acaricides tested under drought conditions against high populations of *E. clarki* proved no more effective than a processed sulphur dust. A spray of 1·25 lb. DN-111 [20 per cent. dicyclohexylamine salt of dinex] per 100 U.S. gals. was very toxic to both *E. clarki* and *Phyllocoptruta oleivorus* in winter when applied with 10 lb. sulphur, but gave poor control of *P. oleivorus* without it, and a dust of 1 per cent. EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] gave poor control of both mites. Dusts containing 10 per cent. Ovotran [p-chlorophenyl p-chlorobenzenesulphonate] in sulphur gave good initial control of *E. clarki*, but permitted increases to high numbers in 1–2 months. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] in a 3 per cent. dust was as effective as other materials against *E. clarki*, but further studies will be necessary to ascertain its effectiveness against *P. oleivorus*. Aramite was superior to parathion, Ovotran, sulphur, Neotran [di(p-chlorophenoxy)-methane] or Sulphenone [p-chlorophenyl phenyl sulphone] in sprays against *E. clarki* in one test, but none of the materials effectively reduced heavy populations. A dust of 1 per cent. Karathane (dinitrocaprylphenylcrotonate) gave poor control of *P. oleivorus* on grapefruit during the spring and summer and did not effectively reduce high populations of *E. clarki*.

JAYNES (H. A.) & DROOZ (A. T.). **The Importance of Parasites in the Spruce Budworm Infestations in New York and Maine.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1057–1061, 2 refs. Menasha, Wis., 1953.

The following is based on the authors' summary. In New York, an outbreak of *Choristoneura fumiferana* (Clem.) arose very suddenly on balsam fir [*Abies balsamea*] and spruce in 1945, reached a peak in the following year and declined rapidly in 1947 [*cf. R.A.E.*, A **39** 234, etc.]. In Maine, a similar outbreak began in 1948, reached a peak in two years and began to decline in 1951. The effectiveness of certain parasites showed a remarkably similar trend in the two regions. *Apanteles fumiferanae* Vier., *Glypta fumiferanae* (Vier.), *Angitia* (*Horogenes*) *cacoeciae* (Vier.) and *Agria affinis* (Fall.) accounted for almost the same percentages of mortality in the two areas. *Trichogramma minutum* Ril., the only egg-parasite reared in Maine, *Zenillia* (*Phryxe*) *pecosensis* (Tns.), *Apechthis* (*Ephialtes*) *ontario* (Cress.) and *Itoplectis conquisitor* (Say) decreased and *Lypha setifacies* (West), *Meteorus trachynotus* Vier. and *Phaeogenes hariolus* (Cress.) increased in effectiveness as host populations declined, and it is considered that population trends of certain parasites may indicate the trend in a host population. Mortality due to causes other than parasites was high throughout the life-cycle.

The population of *C. fumiferana* has remained at a very low level in New York since the end of the outbreak there, but surveys are being continued. In Maine, although the outbreak is not over, it is considered that the decline in intensity observed in 1951 will continue, owing to increased control by parasites and other factors. There is still a considerable population spread over a large area and the danger of another outbreak in the near future cannot be overlooked, especially in view of the possibility of heavy moth flights from Canada, where severe outbreaks are in progress.

HUFFAKER (C. B.) & KENNETT (C. E.). **Ecological Tests on** *Chrysolina gemellata* **(Rossi) and** *C. hyperici* **Forst. in the Biological Control of Klamath Weed.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1061–1064, 2 refs. Menasha, Wis., 1953.

It has been shown in California that *Chrysomela quadrigemina* Suffr. (*Chrysolina gemellata* (Rossi)), which oviposits as soon as the autumn rains begin, spreads rapidly and gives good control of klamath weed [*Hypericum perforatum*], whereas *Chrysomela* (*Chrysolina*) *hyperici* Forst., which does not reach maximum oviposition until three months later, does not [*cf. R.A.E.*, A **39** 316]. Further investigations showed that the larvae of *C. hyperici* throve as well on the tough foliage that develops in early summer as on the lush basal growth typical of late autumn, winter and early spring, and no important differences were found between the two species in the rates of development of eggs and larvae or in ability to survive long periods of summer drought and high temperatures during aestivation. It is therefore concluded that the difference in time of oviposition is the principal cause of the difference in effectiveness.

Rogoff (W. M.). **The Repellency of Chlordane, DDT, and other residual Insecticides to Greenhouse Thrips.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1065–1071, 7 figs., 19 refs. Menasha, Wis., 1953.

Repellency is sometimes of considerable importance in increasing or decreasing the effectiveness of a deposit of a contact insecticide under field conditions, and attempts were therefore made to obtain comparative quantitative data on the repellent properties of several such materials. Acetone solutions of 1 per cent. or less of chlordane, p,p′DDT, heptachlor, γ BHC (as lindane), parathion and dimethyl phthalate were applied to half the upper surface of disks of avocado leaf, a concentration of 1 per cent. being equivalent to a deposit of approximately 50 mmg. per sq. cm. Adults of *Heliothrips haemorrhoidalis* (Bch.) were confined on these, and the numbers on the treated and untreated halves counted after an hour. Repellency (less than 30 per cent. of the thrips on the treated surface) was shown by chlordane and DDT at concentrations of 0·0005 and 0·008 per cent., by parathion, heptachlor and dimethyl phthalate at 0·05, 0·1 and 0·5 per cent. and not at all by γ BHC. This is in inverse relation to the toxicity of these compounds to the thrips [*cf. R.A.E.*, A **37** 196; **40** 107]. When the physical state of the DDT deposits was changed by adding glycerine or DDT oily residue to prevent crystallisation, these showed repellency at a concentration of 0·01 per cent.

Brunson (M. H.). **Reduction of Oriental Fruit Moth in Peach Orchards by Use of Parathion and EPN to control Plum Curculio.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1071–1075, 3 refs. Menasha, Wis., 1953.

The following is based on the author's summary. A study was made in peach orchards in New Jersey in 1950–51 of the effect on *Cydia* (*Grapholitha*) *molesta* (Busck) of sprays of parathion and EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] applied for the control of *Conotrachelus nenuphar* (Hbst.). Parathion was applied at 1·6–2 lb. 15 per cent. wettable powder and EPN at 1·5 lb. 25 per cent. wettable powder per 100 U.S. gals. at shuck split and about 10 and 20 days later, and wettable sulphur was included with all treatments. After the first application, about 97 and 96 per cent. fewer moths were caught in bait-traps in orchards sprayed with parathion and EPN, respectively, than in those treated with lead arsenate. The numbers of infested twigs collected from sample trees between mid-May and mid-July averaged 3·3, 3·8 and 80·2 per tree, respectively, in six orchards sprayed with parathion, two sprayed with EPN and four sprayed with lead arsenate. There was evidence that first-brood moths migrated into the orchards, but the numbers were not sufficient to cause much increase in the numbers of larvae in the twigs. Although no insecticides were applied between early June and harvest, a period of about 2½ months, the percentages of ripe fruits infested averaged only 4·3 in orchards treated with parathion in 1950 and 8·4 and 4·3 in those receiving parathion and EPN in 1951, as compared with 23·7 and 23·1 for lead arsenate in the two years, respectively.

Newcomer (E. J.) & Dean (F. P.). **Orchard Mites resistant to Parathion in Washington.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1076–1078, 3 refs. Menasha, Wis., 1953.

A strain of *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.) resistant to parathion was found in 1951 in an apple orchard in the Yakima Valley of Washington that had received two sprays containing 2 lb.

50 per cent. DDT and 0·5 lb. 25 per cent. parathion per 100 U.S. gals. in May and early June and one of 0·75 lb. 25 per cent. parathion per 100 U.S. gals. in the middle of June. It was successfully controlled on small plots by one application on 28th June of 1 lb. 50 per cent. Ovotran (p-chlorophenyl p-chlorobenzenesulphonate), 15 per cent. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] or 27 per cent. EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] or 2 lb. 40 per cent. R-242 [p-chlorophenyl phenyl sulphone] per 100 U.S. gals., of which the first was the best, and over the rest of the orchard by one of 0·66 lb. EPN per 100 U.S. gals. on 9th or 16th July.

In late July, an infestation of a species of *Tetranychus*, thought by the grower to be the two-spotted mite [*T. bimaculatus* Harvey] or *T. pacificus* McG., developed in the same orchard and proved resistant to treatment with 0·75 lb. 25 per cent. parathion per 100 U.S. gals. on 25th July. It was controlled on small plots by applications on 3rd August of 1·5 lb. 15 per cent. Aramite, 1 U.S. pint 25 per cent. DMC [1,1-bis(p-chlorophenyl)-ethanol] or 0·5 U.S. pints 50 per cent. malathon per 100 U.S. gals. and throughout the rest of the orchard by the Aramite spray applied in early August.

A form of *Tetranychus* resistant to parathion appeared in several other orchards in the Yakima Valley in 1951; in one that had received two applications of 0·5 lb. 25 per cent. parathion per 100 U.S. gals., it was satisfactorily controlled by a spray of Aramite in July. E. W. Baker at first considered this mite to be *T. mcdanieli* McG., but subsequent examination of a greater number of specimens indicated that *T. mcdanieli* may be a subspecies or variant of *T. pacificus*.

FLANDERS (S. E.). **A Parasite of the European Elm Scale established in California.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1078–1079. Menasha, Wis., 1953.

Attempts to control the Coccid, *Gossyparia spuria* (Mod.), a serious pest of European elm in California, included the introduction of two of its parasites, the Aphelinid, *Coccophagus insidiator* (Dalm.), and the Encyrtid, *Trichomasthus cyanifrons* (Dalm.), from Italy in 1939 and from France and Germany in 1948–50. Fertilised females of *C. insidiator* were released in various localities in 1939, 1949 and 1950, and one of the releases in 1949 led to its establishment at Redlands. It was first recovered there in July 1951 from the two infested trees on which it had been liberated, and these were then practically free of scale; infestation was noticeably heavier in 1952, but not causing serious injury, and by June, 85 per cent. of the mature female scales were parasitised and the parasite had spread to trees 100 yards away. Collections of parasitised scales showed that the parasite passed through one generation on the overwintering prepupal males, one on the non-gravid females and 1–3 on the gravid females of *G. spuria*, which has one generation a year. The female of *C. insidiator* develops as a solitary endoparasite, and the male is apparently ectoparasitic on the female parasite.

T. cyanifrons, which is gregarious in development, was reared in the laboratory for one generation and released in three localities in June 1949; it reproduced for one generation at Redlands and then died out. No other recoveries were made. Introductions in 1950 included eight examples of *Microterys* sp. This Encyrtid was reared through one generation in the laboratory, but produced only males. The life-cycles of *C. insidiator*, *T. cyanifrons* and *Microterys* sp. at 80°F. lasted 22, 15 and 17 days, respectively.

Newcomer (E. J.) & Carlson (F. W.). **The Leaf Roller Moth** *Pandemis pyrusana*.—*J. econ. Ent.* **45** (1952) no. 6 pp. 1079–1081, 3 refs. Menasha, Wis., 1953.

Tortrix (*Pandemis*) *pyrusana* (Kearf.) was reared from apple in Washington in 1916 and 1922, but did not cause serious injury until 1948, when it was found there damaging cherry, apricot and plum. Injury to cherries and apricots has since been sporadic but often serious. The larvae feed on the foliage and fruits under webbing; they occasionally burrow into cherries along the pit and sometimes make holes half an inch or more in diameter in all the apricots in a cluster. They overwinter at the base of the tree or in rough bark and resume feeding when new foliage appears, usually before late April. Pupation occurs in early June, usually in rolled leaves, and emergence of the adults reaches a maximum in mid-June. Eggs of the first generation are deposited in flat masses on the leaves and hatch during the latter half of June, and the larvae develop slowly, not giving rise to adults until after mid-August. The adults are present in late August and September, and second-generation larvae appear in late September and enter hibernation in October. Parasitism is uncommon, but *Nemorilla floralis* (Fall.) and *Angitia* (*Horogenes*) sp. have been reared from the larvae.

T. pyrusana is sometimes confused with *T.* (*Amelia*) *pallorana* Rob., which is common in the Yakima Valley, mainly on shrubs and succulent plants, though larvae have been found on apple, cherry and pear; they cause little injury, but occasionally defoliate young apple trees. Characters differentiating all stages of the two species are described.

In tests, good control of *T. pyrusana* was given by dusts containing 10 per cent. DDT or 2 per cent. parathion and sprays of 1 lb. 15 per cent. parathion or 1 U.S. pint 20 per cent. TEPP (tetraethyl pyrophosphate] per 100 U.S. gals., applied to cherry in April 1949 and by sprays of 2 lb. 50 per cent. DDT, 1 lb. 25 per cent. parathion, 1 U.S. pint 20 per cent. TEPP, 0·5 lb. 27 per cent. EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] or 2 lb. 50 per cent. DDD (TDE) per 100 U.S. gals., applied to apricot in April 1951. Sprays should be applied as soon as the blossoms have dropped, when the danger of poisoning bees is past. TEPP is particularly useful, since it can safely be applied up to 1–2 days before picking. Some control of overwintering larvae is given by dusting the trunks with DDT in spring before migration takes place.

Schoene (W. J.) & Sibold (N. V.). **A Virus Disease of the Red-banded Leaf Roller.**—*J. econ. Ent.* **45** (1952) no. 6 p. 1081. Menasha, Wis., 1953.

In August 1949, while *Eulia* (*Argyrotaenia*) *velutinana* (Wlk.) was being reared in the laboratory from material collected in the field in Virginia, increasing numbers of larvae were observed to have assumed an abnormal colour and to be feeding at a reduced rate, and these were reported by E. A. Steinhaus to be infected with a granulosis virus. Larvae that became infected when young died without pupating, but many of those that were half-grown or more when they became diseased pupated; about a third of the infected larvae and pupae observed transformed to adults. In 1950, apparently healthy adults of the laboratory strain were allowed to oviposit, and the newly hatched larvae were reared individually on tender apple leaves. This was done for each of the three generations, and it was found that 28 per cent. of the larvae of the first and 15 per cent. of the second were infected and that 74 per cent. of the third generation were infected by 4th and 97 per cent. by 18th October.

A survey in orchards in most of the apple-producing regions of Virginia in October 1950 showed that some contained no larvae of *E. velutinana* and others small numbers, some of which were diseased in each case, and it is concluded that the disease is general and has already greatly reduced populations of the moth.

GRAY (H. E.). **Insects observed at Sea.**—*J. econ. Ent.* **45** (1952) no. 6 p. 1081. Menasha, Wis., 1953.

The author reports that large numbers of adults of *Musca domestica* L. appeared on a U.S. naval vessel, which was operating in an area 20–40 miles from the coast of Virginia during the daytime, soon after it anchored at 5 p.m. 22 miles from the nearest land for the nights of 12th and 13th August 1952. No flies could be found on the ship during the day, and there were no places on board from which the flies could have emerged, very few ships in the same area, and no strong offshore breezes. He also records the finding of several adults of *Diabrotica undecimpunctata howardi* Barber and two of a species of *Chrysopa*, on the decks on the mornings of 13th and 14th August; these must have settled on the ship during the night.

LIENK (S. E.), DEAN (R. W.), CHAPMAN (P. J.) & LAPLANTE (A. A.). **Resistance of European Red Mite to Parathion.**—*J. econ. Ent.* **45** (1952) no. 6 p. 1082, 1 ref. Menasha, Wis., 1953.

A report was received in July 1952 that *Paratetranychus pilosus* (C. & F.) had developed resistance to parathion [*cf. R.A.E.*, A **41** 208] in an apple orchard in New York that had received two applications of this material in August 1948, one in July 1949, one in July 1950, five in June–September 1951 and four, followed by one of TEPP [tetraethyl pyrophosphate], in May–July 1952. This was confirmed in a test in which thorough application of sprays containing 0·5–2 lb. 15 per cent. parathion wettable powder per 100 U.S. gals. on 22nd or 25th July gave much poorer control than that obtained in other work by two of the authors [**39** 12]. In tests of other acaricides, good control was given by wettable-powder sprays of 0·5 lb. 25 per cent. EPN (O-ethyl O-p-nitrophenyl benzenethiophosphonate) or 1·5 lb. 15 per cent. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] per 100 U.S. gals. and by an emulsion spray of 4 fl. oz. 42 per cent. Systox (O-(2-(ethylmercapto)ethyl) O,O-diethyl thiophosphate) per 100 U.S. gals., showing that the mites were not resistant to these materials, but there were some indications of resistance to malathon, which gave poor results when applied at 2 lb. 25 per cent. wettable powder per 100 U.S. gals.

EDEN (W. G.). **Effects of Kernel Characteristics and Components of Husk Cover on Rice Weevil Damage to Corn.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1084–1085, 2 refs. Menasha, Wis., 1953.

An investigation of the relation between certain components of the husk cover of maize and damage by *Calandra* (*Sitophilus*) *oryzae* (L.) [*cf. R.A.E.*, A **40** 352], carried out just before harvest on a hybrid maize in Alabama, showed that injury decreased as the length of the husk tip increased and as the number of leaves per husk increased, and that the effects of the two characters were independent of each other.

The effect of the hardness of the kernel and the thickness of the pericarp on weevil damage at harvest was also investigated. In shelled samples of maize of 20 varieties and hybrids, adjusted to 12 per cent. moisture content, the pressure required for penetration of the kernels with a $\frac{1}{16}$ in. hollow hard-steel punch was measured for 50 kernels of each variety. It is calculated from the results that for each increase of 1 lb. per sq. in. required for penetration there was a decrease in weevil damage of almost 1 per cent. Measurement of the thickness of the pericarp of the same 20 varieties and hybrids, adjusted to 8 per cent. moisture content, showed that this varied from 92 to 136 μ but did not affect the amount of damage.

Cochran (J. H.). **Organic Phosphate Dusts on the Plum Curculio.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1085–1087, 2 refs. Menasha, Wis., 1953.

As organic phosphates were shown to be effective as dusts against *Conotrachelus nenuphar* (Hbst.) on peach in South Carolina [*R.A.E.*, A **40** 108], laboratory experiments were carried out in 1951 to determine the comparative toxicity of several of them to the adults, the effect of sulphur as a diluent on the toxicity of dusts of parathion and EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] and the effect of storage on dusts of parathion and sulphur.

When applied in 1·5 per cent. dusts to peach twigs from which the growing tips had been removed, EPN and methyl-parathion gave complete kill in 48 hours of adults caged on the twigs, parathion and malathon 76·7 and 78·7 per cent. kill in 144 hours, and Systox [O-(2-(ethylmercapto)ethyl) O,O-diethyl thiophosphate], Potasan (4-methylumbelliferone O,O-diethyl thiophosphate) and schradan only 38·3–45 per cent. kill in 144 hours. Sulphur proved to have little or no effect on the control given by EPN or parathion and is a preferred diluent because of its fungicidal properties. Dusts of parathion in sulphur that were stored in the original bags in a dry place did not decrease in effectiveness after one year, but lost some of their toxicity after two.

In field tests against a low weevil population on peach in 1951, EPN and parathion appeared to be slightly more effective in sprays than in dusts, with no difference between the compounds, but a dust of 1·5 per cent. parathion in sulphur with 3 per cent. petroleum distillate gave as good control as a spray of 13 lbs. per 100 U.S. gals. of a material containing 1·7 per cent. parathion and 42·5 per cent. sulphur. This dust appeared to leave a heavier deposit on the leaves and fruits and did not drift as much as the regular dust of parathion and sulphur, but did not flow through the duster so well. It caused no noticeable injury to the trees.

Ivy (E. E.) & Scales (A. L.). **Insecticides for Cotton Leafworm Control.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1087–1088, 2 refs. Menasha, Wis., 1953.

Laboratory and field-cage tests were carried out in Texas in 1940–50 to evaluate insecticides that might be substituted for those currently recommended for the control of *Alabama argillacea* (Hb.) on cotton. They were tested against larvae in the third instar, and mortality was calculated after exposure on the treated plants for five days. Most of the insecticides were applied as dusts, though a few spray formulations were included, and they were compared with calcium arsenate, or, occasionally, toxaphene, which gave at least 76 per cent. kill when applied at 4–8 and 1 lb. per acre, respectively. Other insecticides that gave at least 76 per cent. mortality comprised parathion and EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] at 0·1 lb. per acre, CS-674A [1,1-bis(p-chlorophenyl)-2-nitrobutane] at 0·125 lb., dieldrin, O-(2-chloro-4-nitrophenyl) O,O-dimethyl thiophosphate, malathon and DDD (TDE) at 0·5 lb., aldrin, CS-645A [1,1-bis(p-chlorophenyl)-2-nitropropane], and 2,3,3a,4,5,6,7,7a,8,8-decachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene-1-one at 1 lb., p,p′methoxy-DDT (methoxychlor), p,p′fluoro-DDT, chlorinated isobornyl phenyl sulphone, chlorinated diisobornyl sulphone, chlorinated pinene and paris green at 2 lb., arsenomethane As-1,2-disulphide [*cf. R.A.E.*, A **40** 181] at 2·5 lb., DDT and methyl-DDT at 5 lb., lead arsenate and basic copper arsenate at 6 lb. and p-aminobenzene hydrochloride, phthalonitrile and BHC (3 per cent. γ isomer) at 8 lb.

VAN LEEUWEN (E. R.). **Fumigation of Chestnuts with Methyl Bromide to control Weevils.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1088–1089, 1 ref. Menasha, Wis., 1953.

In plantings of chestnut in the United States, the crop is harvested by gathering the fallen nuts every day or two, and many of these contain eggs and larvae of *Curculio auriger* (Csy.) and *C. proboscideus* F., though the holes through which the eggs have been inserted are so small that they escape notice. Unless the eggs and larvae are destroyed before much damage is done, the nuts are worthless as seed, and experiments were therefore carried out to develop a schedule for fumigation with methyl bromide. During the winter of 1950–51, chestnuts were fumigated in an air-tight drum at a temperature of about 72°F. with dosages of 2·5–5 lb. methyl bromide per 1,000 cu.ft. for 2–4 hours and set to sprout in a greenhouse, which was heated to accelerate germination. Treatment with 2·5 lb. for 2, 3 and 4 hours, with 3 lb. for 3 and 4 hours and with 3·5 lb. for 4 hours resulted in 85, 72, 75, 83, 75 and 79 per cent. germination, respectively, and treatment with 4 lb. for 3 and 4 hours and with 5 lb. for 3 and 4 hours in 50, 53, 0 and 4 per cent., whereas there was 74–96 per cent. germination of untreated nuts. In the autumn of 1951, unsprayed infested nuts showing no exit holes were fumigated with 2·5 lb. methyl bromide per 1,000 cu. ft. for 2·5 or 3 hours or with 3 lb. for 3 hours, and 3, 2 and 0 per cent., respectively, contained living larvae, as compared with 90 per cent. of untreated nuts.

VAN LEEUWEN (E. R.). **Life History and Habits of the Chestnut Weevils.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1089–1091, 1 ref. Menasha, Wis., 1953.

Curculio auriger (Csy.) and *C. proboscideus* F. cause serious losses in the United States to growers of blight-resistant Asiatic species of chestnut [*Castanea*], which are rapidly replacing the American chestnut [*C. dentata*] [*cf. R.A.E.*, A **38** 332], and investigations on their bionomics were carried out in Maryland in 1946–51. Larvae of both species were liberated in soil cages under chestnut trees as they left the nuts in the autumn of 1948, and adults of *C. proboscideus* emerged from the soil in August and early September in 1949 and 1950, and those of *C. auriger* in May and June 1950 and in May and early June 1951 [*cf.* **18** 113]. Covering developing burs at various dates, in order to prevent further oviposition in them, showed that egg-laying began about the second week of August and continued until harvest. Observations on chestnuts collected from beneath unsprayed trees showed that larvae began to leave the nuts soon after these had fallen and continued to do so for many weeks. The average number of larvae per nut was about seven, and the two species fed together in the same nut. After leaving the nuts, the larvae burrowed into the soil and formed smooth-walled cells. Larvae that had been distributed on the surface of fine sandy loam in September 1949 were found at depths of 0–12 ins. in January 1951, but those in the top inch appeared to be weak and most were 3–5 inches down. No lateral movement of the larvae in the soil was noted.

Roth (A. R.) & Hoffman (R. A.). **A new Method of tagging Insects with P^{32}.**—*J. econ. Ent.* **45** (1952) no. 6 p. 1091, 2 refs. Menasha, Wis., 1953.

The authors describe a method of rendering insects radioactive by dipping them in a solution of phosphoric acid prepared from radioactive phosphorus (P^{32}), with or without a wetting agent, and give the results of experiments in which it was applied to flies [*cf. R.A.E.*, B **41** 108]. It was also used successfully with wasps, several species of Coleoptera, grasshoppers and leafhoppers, but caused about 80 per cent. mortality of Aphids in 24 hours. All took up the P^{32}, but the radioactivity per insect depended on its size and the amount of cuticle wetted.

Fleschner (C. A.) & Arakawa (K. Y.). **The Mite** *Tydeus californicus* **on** *Citrus* **and Avocado Leaves.**—*J. econ. Ent.* **45** (1952) no. 6 p. 1092, 1 fig., 1 ref. Menasha, Wis., 1953.

Tydeus californicus (Banks) is common on the lower surfaces of the leaves of *Citrus* and avocado in California, tending to congregate along the midribs and veins. Eggs are rarely seen, as embryonic development is usually completed within the parent. The mite has been considered to be a predator or to feed on fungi, but was found to feed and reproduce on avocado leaves free from fungus, insects or other mites, and microscopic examination showed that the young mites settled and fed on the leaf surface immediately after hatching. Unlike the six-spotted mite [*Tetranychus sexmaculatus* Ril.], with which it is easily confused, it produces no obvious feeding injury, even when present in large numbers, but it may, nevertheless, be of some importance.

DeBach (P.) & Erickson (L.). **Rooted Lemon Fruits for** *Citrus* **Pest Studies.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1097–1098, 1 fig., 7 refs. Menasha, Wis., 1953.

Lemons, especially large green fruits, cut from the tree with an inch or so of stem attached and allowed to develop roots in sand in the glasshouse, remain in a healthy turgid condition for up to six months under suitable conditions. Rooting is facilitated by dipping the cut stems in 0·2 per cent. naphthaleneacetic-acid powder. Such rooted fruits have been used successfully in California for the culture of the California red scale [*Aonidiella aurantii* (Mask.)], ivy scale [*Aspidiotus hederae* (Vall.)] and the citrus red mite [*Paratetranychus citri* (McG.)]. Heavy initial infestations of *Aonidiella* may lead to premature fruit collapse, probably because of the action of digestive enzymes secreted by the insects, but low initial infestations permit the development of two or possibly three generations. In order to reduce rotting, the fruits should be dipped in a warm solution of 3 per cent. sodium tetraborate.

NICKELS (C. B.). **Control of the Pecan Weevil in Texas.**—*J. econ. Ent.* **45** (1952) no. 6 pp. 1099–1100, 3 refs. Menasha, Wis., 1953.

The results are given of further investigations on the control of the pecan weevil [*Curculio caryae* (Horn.)] on pecan in Texas [*cf. R.A.E.*, A **39** 121]. In two well-timed applications [*cf. loc. cit.*] on 6th and 15th September 1950, sprays of 6 lb. 50 per cent. wettable DDT or 1 U.S. quart 50 per cent. emulsifiable toxaphene per 100 U.S. gals. reduced the percentage of nuts infested at harvest from 68 for no treatment to 6 and 39, respectively; 7 fl. oz. nicotine sulphate and 2 U.S. quarts summer oil per 100 U.S. gals. were added to the sprays applied on 6th September, because the Aphid, *Melanocallis caryaefoliae* (Davis), was abundant. In a heavily infested orchard, two well-timed applications on 23rd August and 1st September and a third, which was too late, on 12th September, of 6 lb. 50 per cent. wettable DDT or 2 lb. 27 per cent. wettable EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] per 100 U.S. gals. resulted in 75 and 99 per cent. infested nuts at harvest, as compared with 99 per cent. on unsprayed trees. Applications of 2 lb. 25 per cent. wettable dieldrin on the first two dates reduced the percentage infestation from 89 to 52 per cent. on 7th–11th September, when the infestation percentages on trees receiving the other treatments were 27 and 74, respectively.

In a moderately infested orchard in 1951, applications of 6 lb. 50 per cent. wettable DDT, 2 lb. 25 per cent. wettable dieldrin and 4 lb. 25 per cent. wettable heptachlor on 16th August reduced the percentage of nuts infested on 28th–29th August from 48 to 3, 5 and 3 respectively.

Soil treatments were tested in 1946. About 50 larvae were put in plots 2 ft. square on 2nd–10th November, and on 15th November, ethylene dibromide was poured by hand into furrows 6 ins. apart and 6 ins. deep and covered with soil, or DDT or BHC (5 per cent. γ isomer) was mixed with water and poured over the soil. The percentages of larvae found dead in the top 10 ins. of soil on 4th-6th December were 68 and 86·9 after treatment with 20 and 40 U.S. gals. 10 per cent. ethylene dibromide per acre, 1·9 and 0·4 after treatment with 30 lb. BHC and 30 lb. DDT, and 0·7 after no treatment, and it is concluded that ethylene dibromide is the only one of these materials worth testing further.

MORALES AGACINO (E.). **The Locust Problem in Central America and Mexico.**—*FAO Plant Prot. Bull.* **1** no. 2 pp. 18–20, 1 map. Rome, 1952.

The migratory locust of Central America and Mexico has been tentatively identified as *Schistocerca paranensis* (Burm.), but may constitute a race differing from the form that is important in South America. It has two main outbreak areas. One of these is situated in the State of Yucatan, Mexico, and gives rise to swarms that migrate south along the Atlantic coast into British Honduras and south, west and north along the coast of the Gulf of Mexico. The other is situated in the parts of Salvador, Nicaragua and Honduras that surround the Gulf of Fonseca and gives rise to swarms that migrate along the Pacific coast in a north-westerly direction through Guatemala into Mexico and south-east through Nicaragua and occasionally into Costa Rica. Swarms also develop in various smaller foci along the Atlantic coastal region of Mexico and in Honduras and Nicaragua, but have not so far shown migratory tendencies. The outbreak areas, foci, and invasion areas are shown on a map.

The locusts cause very great losses of numerous crops in Central America and Mexico, and coffee, though not directly attacked, is affected by locusts defoliating its shade plants. The International Committee of Co-ordination for Locust Control was established in 1949 under a Convention by the governments of Mexico, Costa Rica, Salvador, Guatemala, Honduras and Nicaragua to carry out and co-ordinate research on locusts, investigate outbreak areas, and assist member governments in controlling outbreaks.

Linford (M. B.). **Pineapple Diseases and Pests in Mexico.**—*FAO Plant Prot. Bull.* **1** no. 2 pp. 21–25. Rome, 1952.

Pests observed attacking pineapple in Mexico in June–July 1951 comprised larvae of *Thecla* sp., which is a well-known pest of the fruits; the mite, *Stigmaeus floridanus* Banks, which feeds in the flowers, rendering the fruits unfit for canning, and at the base of the leaves, especially those of slips and crowns, and may retard the growth of young plants or kill them; and *Dysmicoccus* (*Pseudococcus*) *brevipes* (Ckll.), which was frequently found in small numbers, though never on the young leaves in the centre of the plant, where the mealybugs commonly feed when causing wilt disease. In one area, plants appeared to have been affected by wilt some months earlier, but there was no evidence that mealybugs were the cause.

Marcovitch (S.). **Observations on Insect Pests in Israel.**—*FAO Plant Prot. Bull.* **1** no, 2 pp. 25–26. Rome, 1952.

The cultivation of sugar-beet was begun in Israel in 1950, and it soon appeared that attack by *Lixus junci* Boh. was a limiting factor. The larvae of this weevil attack the leaves, which soon wither and fall, and their feeding favours the development of disease organisms. *Lixus*, which is distributed throughout the country, also attacks fodder beet. The adults appear at the end of February, oviposition continues during March–May, and first-generation adults emerge at the end of May and the beginning of June. The second generation, which is larger and more destructive, appears in June–August. To prevent losses of the order of 50–60 per cent., fodder beet must be harvested in June instead of July, when the growing season ends. In July 1951, *Lixus* caused 60 per cent. loss of sugar-beet in one area, where losses in neighbouring fields of fodder beet harvested at the beginning of June were about 20 per cent. In 1952, infestation of fodder beet was only 10 per cent. in the middle of May, when harvesting began, but had increased to 18–20 per cent. two weeks later; losses of sugar-beet harvested in early June were 15–20 per cent., but were much heavier where harvest was delayed until late July.

Other pests of importance in Israel are *Earias insulana* (Boisd.), which destroyed over 90 per cent. of the cotton crop in 1952, and *Vespa orientalis* L. Adults of this hornet feed on ripe fruits and the bark of young trees, killing many young pear and *Citrus* trees, and they also attack honey bees, causing serious losses.

Swain (R. B.). **Insect Problems in Nicaragua.**—*FAO Plant Prot. Bull.* **1** no. 2 pp. 27–28. Rome, 1952.

Anthonomus grandis Boh. and *Alabama argillacea* (Hb.) were very destructive to cotton in Nicaragua in 1951, and were again prevalent in September 1952, when the plants were 3–6 weeks old. The former can be controlled by early and late applications of dusts of Folidol E 605 m [which contains methyl-parathion], 20 per cent. toxaphene, 5 per cent. DDT with 2·5 per cent. aldrin or 10 per cent. chlordane, and Cotton Dust [a proprietary preparation containing 5 per cent. DDT, 3 per cent. γ BHC and 40 per cent. sulphur]; early treatment begins when the plants reach the four-leaf stage, and when infestation of the bolls reaches 10–25 per cent. applications are made at intervals of 3–5 days. *A. argillacea* can be controlled by E 605 m, Cotton Dust, toxaphene and calcium arsenate applied when the larvae appear. *Sacadodes pyralis* Dyar is recorded from cotton in Nicaragua for the first time, but has probably been established there and causing severe damage for many years. Its parasite, *Apanteles thurberiae* Mues., is also established. Chemical control has in general been unsatisfactory, but early treatment with a mixture of toxaphene and DDT at intervals of 4–5 days proved of some value; the removal of débris after harvest, uniform planting dates and the use of early maturing varieties were beneficial. Other insects that damage the bolls are *Heliothis armigera* (Hb.) and, to a less extent, *Prodenia latifascia* Wlk. and *Papaipema* sp. A dust of 10 per cent. DDT alone or with 20 per cent. toxaphene or 3 per cent. BHC is the best treatment against these pests, but is not applied unless they are numerous, in order to avoid injury to their parasites. *Dysdercus* spp. puncture the seeds and stain the lint.

Insects of importance on other crops include the weevils, *Nicentrus saccharinus* Mshl. and *Sphenophorus* (*Calendra*) *incurrens* Gylh., which cause considerable losses of sugar-cane, the Tettigoniid, *Idiarthron atrispinum* Stål, which is an important pest of coffee and can be controlled by dusting with 2·5 per cent. aldrin, 20 per cent. toxaphene or 10 per cent. chlordane at 15 lb. per acre when hatching begins, and *Cosmopolites sordidus* (Germ.), which attacks banana, plantain and abaca [*Musa textilis*], causing loss of vigour, chlorosis, and atrophy of the terminal shoots and the roots. Further, the larval tunnels facilitate the entry of disease organisms, which kill the plants. In studies, the egg, larval and pupal stages lasted 3–5, 75–90 and 10 days, respectively. In addition to the usual traps, control measures comprise consolidation of the soil, earthing up the plants to prevent oviposition and the application of insecticides to plant wounds and the bases of the stems. The most effective are 20 per cent. chlordane and 2·5 per cent. aldrin, though paris green and BHC are also of use.

Outbreaks and new Records, July-August, 1952.—*FAO Plant Prot. Bull.* **1** no. 2 pp. 29–30. Rome, 1952.

New records reported from New Zealand by G. A. H. Helson comprise *Gracillaria azaleella* Brants, which was observed on rhododendrons and azaleas and is not considered a potential danger, *Parlatoria pittospori* Mask. on apple, *Pittosporum*, *Hakea* and certain unspecified Australian shrubs, and mites of the genus *Eriophyes* on a native tree (*Hoheria*), a variegated form of which is sometimes exported as nursery stock.

LOGOTHETIS (C.). **The Migratory Locust in South America.**—*FAO Plant Prot. Bull.* **1** no. 3 pp. 33–35, 1 fig. Rome, 1952.

The present outbreak of *Schistocerca paranensis* (Burm.) in South America, where dense swarms covering areas of over 1,100 sq. miles are not uncommon, began in 1943 and, except for a temporary reduction in intensity in 1950, has continued unabated. Swarms have been present continuously since 1949 in Argentina, which appears to be a major centre of breeding. Large swarms frequently enter Paraguay and Bolivia, but are generally confined to the Chaco provinces, which are of little agricultural importance; at the time of writing, large swarms were present in cultivated areas in both countries, but infestation was not at peak intensity in either. Brazil and Uruguay are sometimes invaded from other countries, the last occasion being during 1946–49. The maximum area affected by the locust extends over eastern Bolivia, parts of Paraguay, west-central and southern Brazil, Uruguay, and north and central Argentina [*cf. R.A.E.* A **39** 137]. Observations on the movement of swarms indicate that the locust is permanently present in the Chaco regions of Argentina, Bolivia and Paraguay (which are partly desert, partly bush and forest land, and very thinly populated), and that swarms disperse from these areas over the rest of the range; the State of Matto Grosso (Brazil) may also occasionally give rise to swarms. Some consider that *S. paranensis* is the swarming phase of the solitary *S. cancellata* (Serv.) [*cf. loc. cit.*], but as some swarms can always be found, other authorities hold that it has no solitary phase.

S. paranensis has one complete generation a year and a partial second. Adults of the first, and more important, develop from eggs laid during September–December and appear at the end of December; they survive for 11–12 months, and most become sexually mature and begin oviposition throughout the invasion area in early September. Some, however, become mature almost immediately; these oviposit from early February until mid-April, and the resulting second-generation adults appear from early May. This second generation does not develop every year in all areas and its occurrence depends on weather. There appear to be two major directional flights. In the first, swarms from all over the invasion area concentrate in the Argentine provinces of Salta and Presidente Peron, where they remain from late January until mid-May. After mid-May they again disperse over the invasion area until the end of August, when oviposition begins. Adults of the second generation mostly remain where they developed.

Control has so far been mainly directed against swarms threatening crops in agricultural areas; BHC is the insecticide generally used, but DNC has given excellent results in Argentina. A Permanent Inter-American Anti-Locust Committee composed of representatives of Argentina, Bolivia, Brazil, Paraguay and Uruguay was set up in 1947 to carry on and co-ordinate research, exchange information on swarm movements, locate permanent breeding grounds, and assist member governments during outbreaks.

Bytinski-Salz (H.). **Two important Tree Borers in Israel.**—*FAO Plant Prot. Bull.* **1** no. 3 pp. 38–39. Rome, 1952.

The Lamiid, *Batocera rufomaculata* (Deg.), was found in Israel for the first time in 1950, and 30 examples, all from fig, were collected in 1951–52. A survey in October 1952 showed that it had not spread beyond the Mount Carmel range. In investigations on the life-cycle, which lasts about a year, adults emerged in June–August and survived for several months, feeding by night on the bark of young fig branches and on the immature fruits. Females laid an average of 2·5 eggs per night over a period of seven weeks, in incisions in the bark. The larvae hatched in 9–10 days in August, fed in the phloem for about three months, during which each destroyed some 27–36 sq. ins. of cambium, and then entered the wood, where they completed feeding and pupated [*cf. R.A.E.*, A **28** 466]; they developed only in stems of older trees or in branches exceeding about 3 ins. in diameter, and characteristic coarse shavings, reddish-brown in colour, were ejected from the galleries. Healthy trees are attacked, and where 5–7 larvae feed in a tree at about the same level, they sometimes girdle and kill it within two or three months; trees are weakened by the presence of only a few larvae. In general, only single trees were found infested, but in one area 6 of 20 trees were dying as a result of infestation. Elsewhere in its range, *B. rufomaculata* attacks mango, and in laboratory tests, development was more rapid in this food-plant than in fig, but the beetle has not been found in the mango-growing districts of Israel. Other trees on the bark or fruits of which the adults fed in tests included *Ficus nitida*, avocado, guava, mulberry, apple and pear; eggs were laid and hatched on most of these, but larval development was retarded, and fig and mango may prove to be the only suitable food-plants for the complete life-cycle. The control measures recommended are burning heavily infested trees and branches, cutting out the larvae while they are feeding beneath the bark, and introducing p-dichlorobenzene into the entrance holes in the wood, which are then plugged.

The Cerambycid, *Phoracantha semipunctata* (F.), which attacks *Eucalyptus* in various countries, was first observed in Israel in 1945, and a survey in 1946 showed that it was present as far south as Ghedera. It spread further to the south in 1949–52, owing to the transport of infested timber. In breeding experiments at two constant temperatures, two overlapping generations developed in the year, of which one was present in March–August and the other in July–April. Both adults and larvae occur almost throughout the year, but become inactive at temperatures below 12°C. [53·6°F.]. Felled trees are attacked within 48 hours in summer, but infestation of healthy standing trees is probably not sufficient to cause serious damage. In inoculation experiments, the larvae were killed by the exuding gum. Trees physiologically weakened as a result of unsuitable soil or excessive drought may be attacked before they exhibit any external signs of their weakened condition. The control measures recommended are felling during winter, when the beetle is inactive, and the use of trap logs in summer; these should be barked or burned after a month, before the larvae enter the wood.

WALKER (R. L.). **Spiny Bollworm of Cotton in Iraq.**—*FAO Plant Prot. Bull.* **1** no. 3 p. 42. Rome, 1952.

Earias insulana (Boisd.) is an important pest of cotton in Iraq, where it attacks both the native *Gossypium herbaceum* and the introduced and more widely cultivated *G. hirsutum*. Ratoon cotton and hollyhock (*Althaea rosea*) are the most important alternative food-plants in spring before seedling cotton becomes available, though other malvaceous plants, including Manchurian jute (*Abutilon avicennae*), which is being cultivated experimentally, Deccan hemp (*Hibiscus cannabinus*) and okra (*H. esculentus*), are also attacked. In 1951, infestation of cotton was reported to be so high that no crop was harvested on many farms. Extensive observations in the Baghdad area in 1952 showed that infestation of squares and bolls on untreated plants reached 40–70 and 45–55 per cent., respectively, at the end of September, and losses in yield amounting to 40–80 per cent. were expected. These were likely to be increased as a result of infection by the boll rot fungi, *Rhizopus* spp. and *Aspergillus* spp.; examination of infected bolls indicated a constant association of fungus infection with feeding by *E. insulana*. In experiments on chemical control, several recently developed insecticides, notably endrin [the endo-endo isomer of dieldrin] and dieldrin, showed considerable promise; when treatment of heavily infested plants was begun in mid-August, an excellent top crop was produced on the second growth, but infestation prior to treatment caused complete loss of the bottom crop.

Autuori (M.) & Pinheiro (J. V.). **Combate á saúva com brometo de metila.** [The Control of Leaf-cutting Ants with Methyl Bromide.]—*Biológico* **16** no. 8 pp. 147–159. São Paulo, 1950.

Further tests were carried out in São Paulo in 1950 on the use of methyl bromide against leaf-cutting ants of the genus *Atta* [*R.A.E.*, A **41** 11]. In the first, in which 120 nests were treated in late May, the methyl bromide was used at 1, 2 or 3 cc. per sq. m. of nest surface, and the doses were applied in equal parts through holes so arranged that there was one in each 5, 10, 15 or 20 sq. m. of surface. The results were estimated in late June and early July, when it was found that mortality was complete in all the nests treated with 3 cc. methyl bromide per sq. m. through one hole per 5 or 10 sq. m., and in 9 of 10 treated with 2 cc. through one hole per 10 sq. m. The other treatments were less successful. In the second test, treatment with 2 and 3 cc. methyl bromide per sq. m., with a minimum of 20 cc. per nest, was applied in late July to 79 and 74 nests, respectively, through one hole per 10 sq. m. Mortality was complete in 60 nests in each group after 40 days and in 64 and 65, respectively, after three months.

Duval (G.). **Contrôle da broca do bambu com soluções oleasas de inseticidas clorados.** [The Control of *Dinoderus minutus* with Oil Solutions of chlorinated Insecticides.]—*Biológico* **16** no. 8 pp. 159–162, 2 refs. São Paulo, 1950.

Following a test made in São Paulo in 1948 in which a spray of 10 per cent. DDT in diesel oil completely protected bamboo from attack by *Dinoderus minutus* (F.) [*cf.* also *R.A.E.*, A **38** 369], several chlorinated insecticides were tested for this purpose in 1950. Culms of giant bamboo, still green, were cut into pieces 8 ins. by 2 ins. and brushed at the rate of 3 cc. per piece with diesel-oil solutions of γ BHC (in a 91 per cent. concentrate) or technical DDT, toxaphene or chlordane, prepared hot and allowed to cool. The treated pieces were placed on racks over infested material and examined for attack after 100 days. It was found that solutions of 2·5–10 per cent. DDT and 0·75–3 per cent. BHC gave complete or almost complete protection, and even when small entrance holes had been made, infestation did not become established. Toxaphene at 5–20 per cent. resulted in averages of 3·2–6·8 entrance holes per piece, but all were superficial. Chlordane at 1·25–5 per cent. gave averages of 5·4–11·4, and although the treatment did not prevent attack, all the beetles found were dead. The average was 83·4 for pieces treated with diesel oil alone, and some of these were completely destroyed, as were all the control pieces, for which the average was nearly 150 holes per piece. DDT and BHC were significantly better than toxaphene, and this doubtfully superior to chlordane; there were no significant differences between concentrations of any material.

Simmonds (H. W.). **The Establishment of the Black Scale Parasite *Metaphycus helvolus*, Compere (Hymenoptera, Encyrtidae) in South Australia.**—*J. Dep. Agric. S. Aust.* **54** no. 8 pp. 398–400, 1 col. pl., 5 refs. Adelaide, 1951.

Metaphycus helvolus (Comp.) was introduced into South Australia in 1943–44 for trial against *Saissetia oleae* (Bern.) on *Citrus*. Laboratory colonies were established, and releases were made. The Encyrtid was found to attack second-instar nymphs of *S. oleae*, *S. nigra* Nietn., *Coccus hesperidum* L. and *Eucalymnatus tessellatus* (Sign.). Since *S. oleae* produces only one generation a year in South Australia [**41** 126], an alternative host was required for breeding in the laboratory during the period when *S. oleae* was unobtainable in the correct stage in the field. *C. hesperidum* proved unsuitable as it was attacked by *M. alberti* (How.), a native Encyrtid that is indistinguishable from *M. helvolus* when alive, and that could not be prevented from contaminating the cultures. *S. oleae* was found to breed fairly continuously on oleander in the greenhouse, and as this plant is not attacked by *C. hesperidum*, *M. alberti* was excluded. However, rearing was eventually carried out in *E. tessellatus* on *Brachychiton* spp., on which *S. oleae* could also be slowly established. A disadvantage of glasshouse rearing was that temperatures fatal to the parasite were occasionally reached, but no technique proved satisfactory for uncontrolled temperature conditions.

At 72°F., the life-cycle of *M. helvolus* lasted about 14 days for males and a little longer for females, but if the temperature fell, even for a few hours, it was prolonged up to 42 days and emergence became irregular. Males predominated among the parasites that developed in young hosts that were easily punctured by ovipositing females, and females among those in older, less readily punctured ones. Characters are given differentiating *M. alberti*, *M. helvolus and M. lounsburyi* (How.), which is widely distributed on *S. oleae* in South Australia [*cf. loc. cit.*]. *M. helvolus* invariably occurred singly in a host, whereas a male and female of *M. alberti* were often present together. Attempts to hybridise these two species were unsuccessful, though intermediate forms were observed. When field-collected adults of *Metaphycus* were to be used as breeding stock, it was necessary to rear the parasites for one generation in *S. oleae* on a food-plant not attacked by *C. hesperidum* in order to ensure that only *M. helvolus* was present. About 2,100 adults of *M. helvolus* were released in the suburbs of Adelaide, where *Citrus* is common in gardens, and in four commercial *Citrus*-growing areas during 1943–47, and small numbers were subsequently recovered from two of the suburbs [*cf.* **35** 162; **36** 216] and, in 1947, from one of the commercial areas. Some recoveries were made from olive, which is also infested by *S. oleae*, but they were less numerous than from *Citrus*, probably because *Coccus hesperidum* also occurs on the latter.

Several Hymenopterous parasites were reared from *C. hesperidum* on *Citrus* during the work. *Coccophagus scutellaris* (Dalm.) and *M. alberti* occurred during 1943–46, the former being dominant. During 1944–45, *Aphobetoideus comperei* Ashm. was present in small numbers. *Adelencyrtus simmondsi* Comp. was reared from one orchard at Adelaide in the same year and increased over the next two years, becoming co-dominant with *M. alberti* in 1946–47. *M. helvolus* appeared in the same locality in the same season, and by mid-winter was beginning to be as numerous as the other two species. With the exception of *C. scutellaris* and *M. helvolus*, all were confined to *Coccus hesperidum*.

Blunck (H.). Ed. **Tierische Schädlinge an Nutzpflanzen. Erster Teil.** [Animal Pests of Economic Plants. Part I.]—Sorauer (P.). *Handb. Pflanzenkr.* **4,** 5. Aufl., 2. Lief., viii+518 [+1] pp., 158 figs., many refs. Berlin, P. Parey, 1953. Price, cloth, *DM.* 116; paper, *DM.* 112.

This is the second part of the fifth edition of the fourth volume of Sorauer's text-book [*cf. R.A.E.*, A **38** 300] and contains the sections on Trichoptera (pp. 1–2) and Lepidoptera (pp. 2–459). As compared with the fourth edition [**13** 163], the number of species of Lepidoptera included has been considerably increased, and the information on their distribution, bionomics, food-plants, natural enemies and control expanded and brought up to date. Some changes in nomenclature have been made.

Nuorteva (P.) & Kanervo (V.). **Einwirkung von Thysanopterenschädigung auf die Backfähigkeit des Weizens.** [Effect of Injury by Thysanoptera on the Baking Quality of Wheat.]—*Ann. ent. fenn.* **18** no. 3 pp. 137–147, 6 graphs, 13 refs. Helsinki, 1952.

The saliva of certain Pentatomids has been shown to contain proteolytic enzymes that destroy the gluten in wheat grains on which they have fed and thus reduce the baking quality of the flour [*R.A.E.*, A **32** 160; **40** 127]. Since thrips commonly infest wheat in Finland, experiments to discover whether their feeding had a similar detrimental effect were undertaken with spring wheat grown in 1951, 38 per cent. of the grains of which showed feeding punctures of *Haplothrips aculeatus* (F.) or *Frankliniella tenuicornis* (Uzel). More of the injured than of the uninjured grains had germinated during harvest, and this is known to reduce the baking quality, but in several tests by techniques that are described, there were no differences between dough made from injured and uninjured wheat. Ductibility tests with gluten from dough that had been allowed to stand at 20–22°C. [68–71·6°F.] for varying periods showed appreciable proteolytic activity in that from infested grains only after 18 hours. The effect of saliva remaining on the exterior of the grains was investigated by testing dough prepared with a water extract of the bran, but no proteolytic activity was found. It is concluded that feeding by thrips has no direct effect on the baking quality of the flour.

Johansson (A. S.). **Studies on the Relation between** *Apanteles glomeratus* **L. (Hym., Braconidae) and** *Pieris brassicae* **L. (Lepid., Pieridae).**—*Norsk ent. Tidsskr.* **8** pt. 4–5 pp. 145–186, 12 figs., 30 refs. Oslo, 1951.

A detailed account is given of laboratory studies in Norway begun in 1946 on the relation of the stage of development of *Pieris brassicae* (L.) to parasitism by *Apanteles glomeratus* (L.). Both host and parasite are common near Oslo, and were readily obtained from cabbage fields. The following is largely the author's summary of the results. Oviposition occurred most readily when the host was exposed to three or four females of *Apanteles* in a test-tube in which they had lived for several days. The optimum temperature for oviposition was 18–22°C. [64·4–71·6°F.]. Females recently collected in the field did not oviposit readily, and those deprived of food or water did not oviposit at all. The parasites readily oviposited in eggs, larvae in all instars and prepupae, but only 2 of over 100 pupae and 3 of 25 adults were attacked, though some eggs were laid in both of these stages. Oviposition was attempted in dead first-instar larvae and dying fully fed larvae from which parasite larvae had emerged one week earlier. First-instar larvae a few days old were the most suitable for oviposition. About 30 parasite larvae were usually found after one insertion of the ovipositor in larvae in the first three instars [*R.A.E.*, A **24** 308]. The parasites completed their development when eggs were attacked immediately before hatching and when larvae were attacked in the first four instars or on the first day of the fifth; younger host eggs attacked either died or gave rise to unparasitised larvae. Host larvae that were attacked on the first day of the fifth instar and contained only a few parasites died as pupae; if several hundred parasites were present in such a larva, it died without pupating and the parasites did not emerge, but when 26–128 parasites were present, they emerged normally from the host larva. Hosts attacked later in the fifth instar or as pupae or prepupae died as pupae without any parasite emergence. The maximum numbers of parasites that developed in single hosts from which some emerged were 86, 234, 249, 324 and 128 when the host was attacked in the first, second, third, fourth and fifth instars, respectively.

In general, all the parasite larvae in a host left it simultaneously, but in a few cases emergence of some individuals was delayed for up to two days. Of those that did not emerge, some were unable to leave the host and others were not sufficiently advanced in development; the latter died 3–4 days after the general emergence. When there were many parasites in one host, they rarely all emerged from it, and a larger proportion failed to do so than when only a few were present. Of the host larvae that were attacked in the first instar, about half still contained larvae after the general emergence, and 9·5 per cent. of the parasites did not emerge from them. Both proportions increased progressively in second-, third- and fourth-instar hosts. Where up to 60 parasites were present, more failed to emerge from hosts attacked in the second or third instars than from those attacked in the first or fourth. There was only one mass emergence from hosts that had been parasitised twice at intervals of 0·5–12 days. If the interval between the attacks was 0·5–1 day, or possibly as much as six days, both parasite broods emerged together; if it was 3–4 days, all the first brood larvae became fully grown and most emerged, but very few of the second brood developed, and if it was 8–12 days, the second-brood larvae did not become fully grown.

The parasites developed more rapidly in older larvae than in those in the first instar, and their development was retarded when many were present in the same host. They left the host when it was preparing for pupation, regardless of the stage in which it was attacked [*cf.* **22** 38], the development of host larvae attacked in the later stages being retarded and that of the parasites accelerated. The rate at which the parasites developed was not dependent on the amount of food available, since even when less than ten were present in larvae that were attacked in the first instar, only two, which emerged during the fourth-instar, left before the prepupal stage. Ligaturing the thorax of fifth-instar host larvae and removing the parts of the body anterior to the ligature, before the hormone that regulates pupation was secreted, had no effect on parasite development. It is concluded that there is a strong reciprocal influence in the regulation of development in host and parasite, the full nature of which is at present unknown.

FRAPPA (C.). **Les insectes nuisibles au vanillier dans la région malgache.**—*Bull. agric. Madagascar* **3** no. 22 pp. 14–20. Tananarive, 1950.

Many insects attack vanilla in Madagascar and its dependencies, but they do not usually cause serious damage. The Pentatomid, *Memmia vicina* (Sign.), is the most abundant of the Hemiptera that infest the plant in Madagascar. It is scarce from May to October, but numerous in the rainy season, and attacks the flower buds, peduncles, flowers and pods and sometimes causes serious losses. It also feeds at the ends of young shoots, causing malformation of subsequent growth. The best method of control is hand-collection of eggs, nymphs and adults 2–3 months before flowering. Bags can be used to protect the pods, though this is expensive, and the use of trap plants is also recommended. *Nezara viridula* (L.), which occurs in Réunion as well as Madagascar, deposits egg-masses on the stems and leaves and feeds on the sap of the stems and flower buds. If numerous, it can be controlled by means of trap plants, particularly castor [*Ricinus communis*], a favoured food-plant in Madagascar. The Coreid, *Anoplocnemis madagascariensis* (Sign.) feeds on the sap of flowers, stems and pods and causes more rapid wilting than the other bugs; trap plants such as *Crotalaria* and *Cassia* should be used for its control. *Dysdercus fasciatus* Sign. and *D. flavidus* Sign. have been collected on vanilla in Madagascar, but these Pyrrhocorids appear to cause less damage than the other Hemiptera.

The pests that cause most damage to the plants are the weevils, *Perissoderes oblongus* Hust., which is abundant on the east coast of Madagascar, and *P. ruficollis* Waterh, which is most injurious in the north-west and in the Comoro islands. *P. oblongus* is a forest species that has become adapted to vanilla. Larvae, pupae and adults are present at all seasons. The adults are most numerous between September and December, feed on leaves and young shoots, and deposit their eggs at a node near the base of the plant. The larvae are commonest early in the year and feed and pupate in the stem. The whole stem above the point of attack dies, and the wounds permit the entry of injurious fungi. Infested plants should be cut and burnt, the transport of pods and cuttings from contaminated areas forbidden, adults collected by hand, and indigenous food-plants near the plantations destroyed. Larvae of *P. ruficollis* also bore in the stem, causing it to die above the point of attack, and the best method of control is to cut and burn infested stems before the adults emerge. Other Coleoptera that cause less injury are the Melolonthid, *Hoplia retusa* Klug, adults of which feed on the flowers in Réunion, the weevil, *Cratopus punctum* (F.), which occurs in Madagascar and the Comoro islands and causes similar damage, the Criocerid, *Bradylema grandis* Klug, larvae and adults of which attack the flower buds, and *Sagra* spp., which devour the leaves and young buds, both in Madagascar.

Larvae of *Plusia orichalcea* (F.) (*aurifera* (Hb.)) sometimes attack vanilla in Madagascar. Infested pods and flowers should be destroyed, and sprays of vegetable-oil emulsion applied if the larvae are numerous. Larvae of the Tortricid, *Phalonia vanillana* (de Joann.), attack the pods. The females generally oviposit on the corolla while it is withering after artificial fertilisation, and oviposition can be prevented by removing this immediately fertilisation has been effected.

Papers noticed by Title only.

[Mertin (J. V.).] **Pesticides Quarterly Supplement. Index to Supplements nos. 1–4, Feb.–Nov. 1952.**—pp. 263–271, multigraph. [Canberra] Dep. Hlth. Aust. [1953.] [*Cf. R.A.E.*, A **41** 155.]

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O'Colla (P.). **The Analysis of chlorinated organic Insecticides by Partition Chromatography on Paper and on Cellulose Columns.**—*J. Sci. Fd Agric.* **3** no. 3 pp. 130–135, 3 figs., 36 refs. London, 1952.

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